REPAIR MANUAL

for the MZ Motor-cycle

ETZ 250

with 2o1 illustrations

and

29 drawings of special tools

VEB MOTORRADWERK ZSCHOPAU

Betrieb des IFA-Kombinats Zweiradfahrzeuge

The ETZ 250 MZ Motor-cycle is a product from VEB Motorradwerk Zschopau, Betrieb des IFA-Kombinats Zweiradfahrzeuge

This Repair Manual was written by a group of engineers in the employ of the manufacturer.

VEB FACHBUCHVERLAG LEIPZIG

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Preface

In the high latitudes of Finland, in the parching heat of Africa, and under the most different operating conditions, MZ Motor-cycles run to the satisfaction of their owners.

To ensure that the vehicles remain in perfect working order and reliable in service after a long period of operation, involving a certain amount of wear, we issue this Repair Manual to give the necessary instructions to our MZ-Workshops at home and abroad.

Repair work is a matter of confidence in several respects:

The safety of the driver depends on the reliability of the mechanic and his excellent workmanship.

Finding the actual cause of the trouble ensures that no material is wasted and labour costs are restricted to a minimum.

From these items, three advantages result:

1. no retouching work,
2. short times of inoperation and
3. low repair costs!

Good workmanship in repairs largely depends on the use of the special tools and means recommended by MZ. We should like to underline that especially self-service workshops and amateur constructors should bear this in mind to avoid considerable additional expenditure of labour and material.

Our authorised MZ-Workshops may purchase the special tools from the MZ Spare Sales Department - for amateur constructors and the like, however, there is only the possibility of constructing them with the help of the sketches given in Section 8.2.

We hope this Reference Book offers the required information to the staffs of the workshops contracted for servicing our products at home and abroad, and to the friends of MZ motor-cycles throughout the world; and we wish good success to each and all.

VEB MOTORRADWERK ZSCHOPAU
Betrieb des IFA-Kombinats Zweiradfahrzeuge
Service Department

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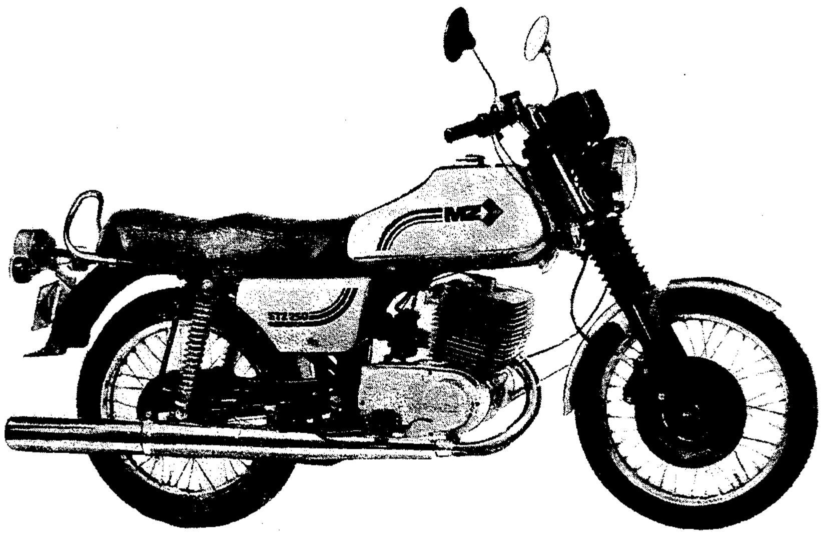
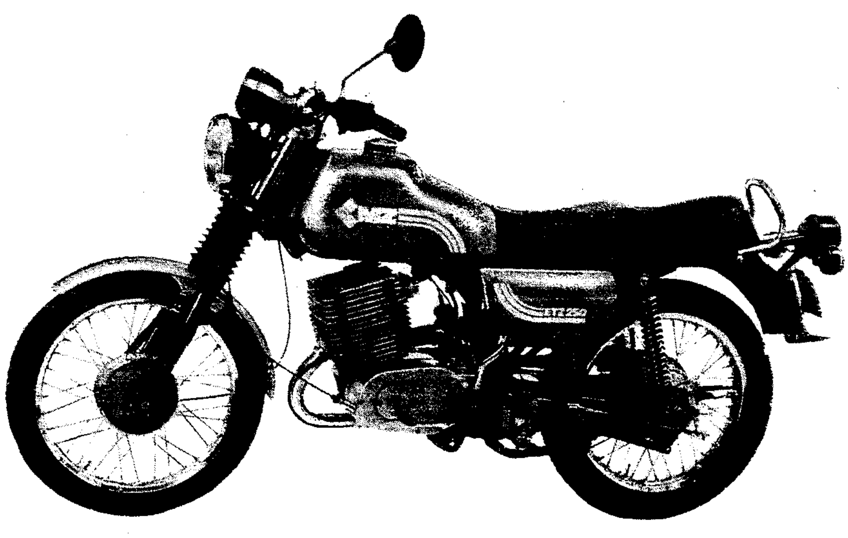


Fig. 1. ETZ 250 with disk brake



Fi. 2. ETZ 250 with drum brake in standard design

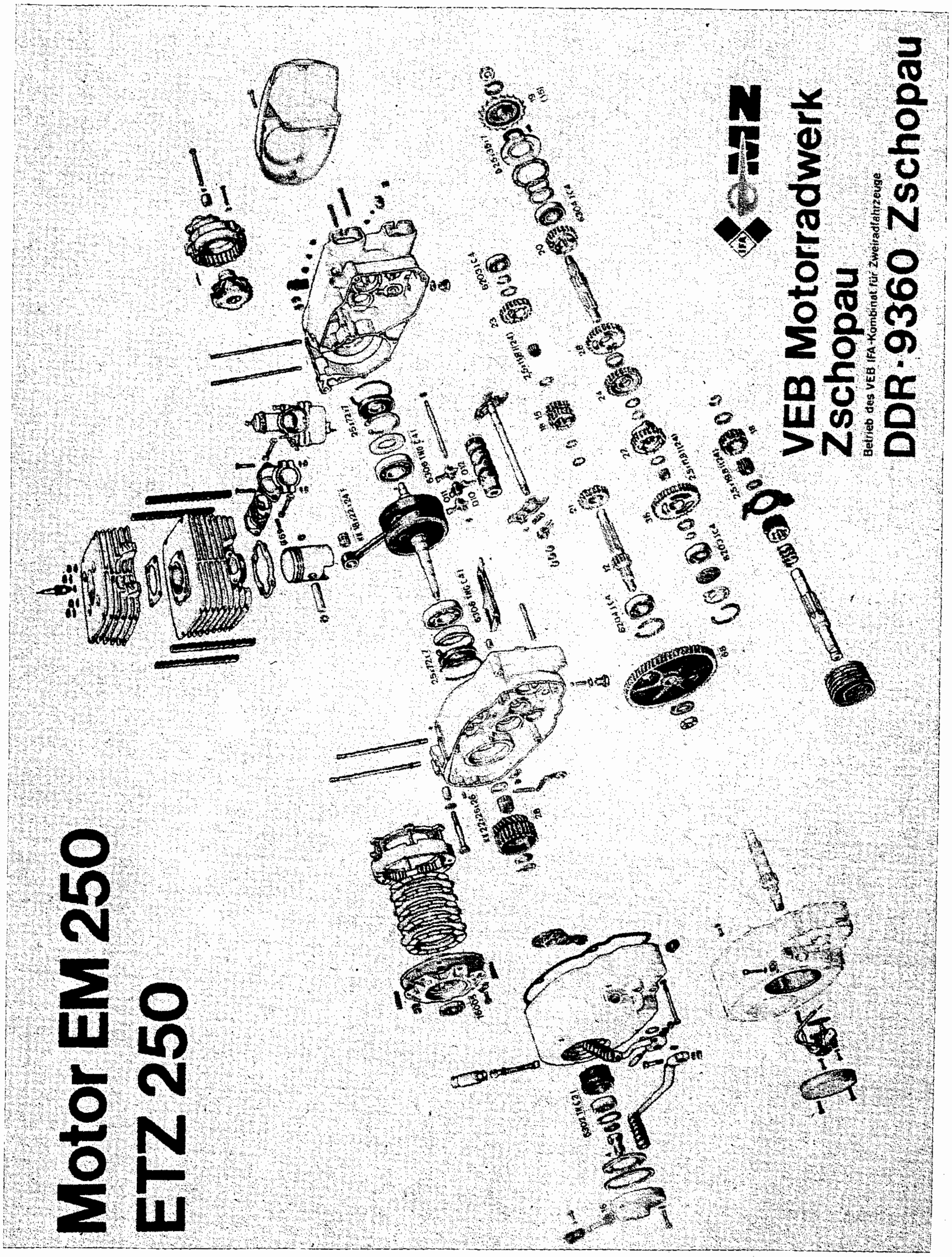


Fig. 3. Exploded view of the engine EM 25o

1. Technical Data

1.1. Engine

Engine type	EM 250
Cycle	two-stroke reverse scavenging
Cooling system	air-cooled (relative wind)
Number of cylinders	1
Stroke / bore	65 mm / 69 mm
Swept volume	243 cm^3
Ratio of compression	10.5 : 1
Compression volume of cylinder head (when assembled)	about 26 cm^3
Maximum output (at about 5,500 rpm)	15.5 kW (21 hp)
Maximum torque (at about 5,200 rpm)	27.4 Nm (2.8 kpm)
Lubrication	petroil lubrication 50 : 1 (or, for selected export countries, by means of oil proportionating pump)
Connecting-rod bearings	cage-type needle bearings for big end and gudgeon pin
Crankshaft main bearings	2 bearings 6306 C 4 f 1 bearing 6302 C 3 f
Timing angle	
Induction	155° crank angle
Transfer	123° crank angle
Exhaust	180° crank angle

1.2. Carburetter

1.2. Carburetter	BVF 30 N 2-5
Transfer port	30 mm
Main jet	130
Needle jet	70 (with cross bore)
Partial-load needle	C 6 with 5 notches
Needle position from top	3 to 4 [1] (4th for running-in period)
Starting jet	90
Slow-running jet	45
Float valve	20
Slow-running air screw	about 1 revolution open
Throttle-valve, valve opening	5 mm

1.3. Electrical Equipment

Ignition	battery ignition
Ignition timing	$3.0_{-0.5}$ mm before T.D.C. ≙ 22° 15' -2° crank angle
Contact breaker points gap	$0.3^{+0.1}$ mm
Sparking-plug	M 14-260
Electrode gap	0.6 mm
Dynamo	12 V, 210 W, three-phase current
Rectifier	silicon semi-conductor in three-phase bridge circuit
Regulator	single-system regulator, temperature-compensated, positive-regulating
Battery	12 V, 9 Ah
Ignition coil	12 V, miniature ignition coil
Headlamp	light opening 170 mm in diameter, asymmetrical passing beam
Stop, tail and number-plate lighting fitting	light opening 120 mm in diameter

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1) Besides the driving habit, the sparking-plug appearance is decisive for the setting.

Horn	under the fuel tank
Direction indicator	4-lamp flashing-light system
Switches	
Ignition-light switch	in instrument pod
Switch combination at handle-bars	dimmer switch, direction indicator system, electric horn, by-pass light signal
Stop-light switch	in rear-wheel hub and front-wheel hub or brake master cylinder

Electric bulbs

Headlamp	12 V,	45/40 W (twin-filament)	TGL 11 413
Parking light	12 V,	4 W cap Ba 9 s	TGL 10 833
Stop light	12 V,	21 W cap Ba 15 s	TGL 10 833
Direction indicator	12 V,	21 W cap Ba 15 s	TGL 10 833
Tail light	12 V,	5 W cap Ba 15 s	TGL 10 833
Charging control light	12 V,	2 W cap Ba 7 s	TGL 10 833
Idling indicating light	12 V,	2 W cap Ba 7 s	TGL 10 833
High-beam headlight indicator	12 V,	2 W cap Ba 7 s	TGL 10 833
Control of direction indicator	12 V,	2 W cap Ba 7 s	TGL 10 833
Speedometer illumination	12 V,	2 W cap Ba 7 s	TGL 10 833

Fuses

Main protection (2 fuses)	fuse link 16 A
Direction indicator system	fuse link 4 A
Dynamo (line DF)	miniature fuse 2 A

1.4. Gearbox

Clutch	on the left-hand end of crankshaft - in oil bath (5 friction disks with cork portions)
Gear-shift system	foot-operated
Number of speeds	5

Gear ratios

1st speed	3.0 : 1 ≙ 12 : 36
2nd speed	1.865 : 1 ≙ 15 : 28
3rd speed	1.333 : 1 ≙ 18 : 24
4th speed	1.048 : 1 ≙ 21 : 22
5th speed	0.87 : 1 ≙ 23 : 20

1.5. Power Transmission

Transmission

Engine - gearbox	2.43 : 1
by helical gears	28 : 68 teeth

Transmission

gear - rear wheel	19 : 48 teeth ≙ 1 : 2.52 (solo operation 15 : 48 teeth ≙ 1 : 3.2 (side-car operation)
by roller chain	0.8 B-1-130 TGL 11 796 (12.7 mm x 7.75 mm x 8.51 mm, 130 rollers) for solo operation 0.8 B-1-128 TGL 11 796 (12.7 mm x 7.75 mm x 8.51 mm, 128 rollers) for side-car operation

Total gear ratio

1st speed	18.406 : 1
2nd speed	11.453 : 1
3rd speed	8.181 : 1
4th speed	6.428 : 1
5th speed	5.335 : 1

1.6. Cycle Parts

Frame	central tubular frame (welded rectangular section)
Engine suspension	top at cylinder head and rear at casing
Steering angle	63 degrees
Castor	95 mm

Type of springing	
front	telescopic fork with oil-hydraulic damping, spring deflection 185 mm
rear	suspension units with spring load and oil-hydraulic damping, spring pre-load adjustable, spring deflection 105 mm
Wheels	wire-spoke wheels with non-offset spokes
Rim size	
front	1.60 x 18
rear	2.15 B x 18
Tyres	
front	2.75 - 18
rear	3.50 - 18
Tyre inflation pressure	
solo: front	150 kPa (1.5 kp/cm^2)
rear	190 kPa (1.9 kp/cm^2)
with permissible total load:	
front	170 kPa (1.7 kp/cm^2)
rear	250 kPa (2.5 kp/cm^2)
Brakes	
front	drum brake, diameter 160 mm width of lining 30 mm actuation by cable control or hydraulic single-disk fixed saddle brake brake disk diameter 280 mm
rear	drum brake, diameter 160 mm width of lining 30 mm actuation by linkage

1.7. Weights

Weight unladen (with fuel and tools)	151 kg (design with drum brake, front) 153 kg (design with disk brake, front)
permissible total weight	330 kg

1.8. Capacities

Gearbox	1,000 cm^3 of gear oil SAE 80
Fuel tank	17 l of fuel-oil mixture, including 1.5 l of reserve
Oil reservoir for oil proportionating system	1.3 l
Telescopic fork	230 cm^3 of damping fluid per member

1.9. Dimensions, Measured Values, Diagrams

Maximum speed	125 to 130 km/h depending on load, weather conditions and sitting position
Acceleration from 0 to 80 km/h	6.6 s
Fuel consumption	3.5 to 5 l/100 km

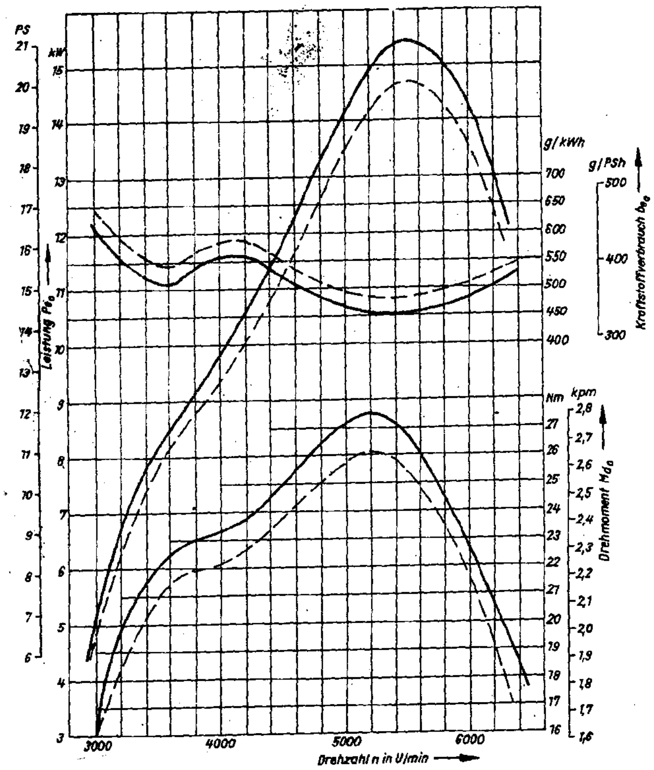


Fig. 4
Full load characteristics of the engine EM 250

Drehzahl in U/min = speed in rpm

Drehmoment = torque

Kraftstoffverbrauch = fuel consumption

Leistung = output

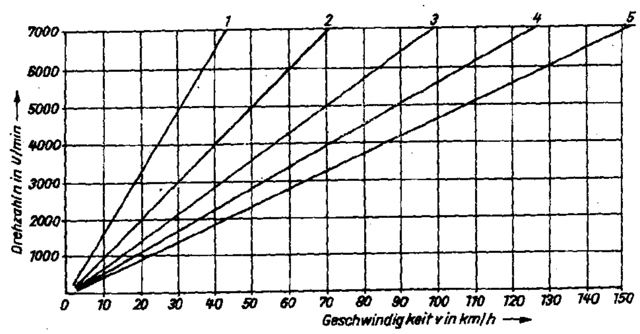


Fig. 5
Speed/gear diagram
ETZ 250 - Solo

Geschwindigkeit v in km/h = speed v in km/h

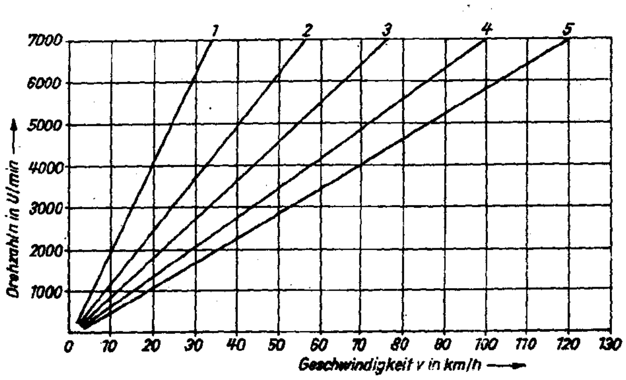


Fig. 5a
Speed/gear diagram
ETZ 250 - side-car design
Geschwindigkeit v in km/h = speed v in km/h

2. Fuel, Lubricants and Fluids

2.1. Fuel

According to the design of the engine, a petrol of an octane rating of at least 88 (in the GDR abbreviated as "VK 88") should be used.
In countries other than the GDR, the use of a fuel with a similar rating is recommended.

2.2. Two-stroke Engine Oil for Fuel-Oil Mixture

Engine oil is added to petrol in the RATIO of 1 : 50
(e.g. 0.2 litres of engine oil are added to 10 litres of fuel).
The mixing ratio of 1 : 50 also applies to the running-in period.
The two conrod bearings, the cylinder liner and the 6306 crankshaft main bearings as well as the piston are provided with oil by this simple and reliable system of petroil lubrication.
Experiences gathered in the course of many years have shown that it is advisable to use
TWO-STROKE ENGINE OIL MZ 22
in the GDR. This additive-type oil meets the following requirements:

viscosity at 50 °C	20 to 25 cSt
pour point maximum	- 30 °C

It contains additives which effect a high temperature and pressure resistance. Limited tendency to coking; prevention of carbonaceous oil deposits or dissolving them. Wear reducing and corrosion preventing properties. Contains lead-separating agents preventing whisker formation in sparking-plugs.

FOR MZ MOTOR-CYCLES IN OPERATION IN COUNTRIES OTHER THAN THE GDR
it is also advisable to use only tow-stroke engine oils which possess these properties (e.g. Shell 2 T, Castrol 2 T, Aral 2 T, Mixol "S", LT-2T, etc.).

2.3. Oil Capacity of Gearbox

For gearbox and primary drive, an amount of 900 cm3 of "GL 60" gear oil is required. This is an additive-type gear oil which is uitable for the lubrication of change-speed gearbox and axle drives. It is an ageing-resistant refined lubricating oil with additives for an increase of the load-bearing capacity and a reduction of wear.

It has favourable low-temperature properties and meets the following technical requirements:

viscosity at 50 °C	53 to 68 cSt (corresponds to 8 °E roughly)
pour point maximum	- 25 °C
flash point	180 °C
water content	0.1 %

In countries other than the GDR, engine oil SAE 30 or 40 or gear oil SAE 80 with similar properties should be used.

2.4. Lubricants for Cycle Parts

The following lubrication points of the cycle parts must be lubricated with "Ceritol +k2" or "Ceritol +k3" antifriction bearing grease:

Steering bearing, wheel bearings, bearing for rear wheel drive, secondary chain, brake cams and brake shoe bearings, foot-operated brake shaft and speedometer drive (the two latter items only when being mounted or repaired).

This antifriction bearing grease has a drop point of about 130 to 150 °C, can be used for a temperature range from - 20 to + 100 °C, and is water-resistant at + 50 °C.

IN COUNTRIES OTHER THAN THE GDR, an antifriction bearing grease of similar characteristics should be used.

2.5. Shock-absorber Oil - Telescopic Fork

As damping liquid, a mixture of

45 parts of shock-absorber oil and
1 part of molybdenum disulphide

should be used.

Shock-absorber oil viscosity:

8 to 11 cSt at 50 °C corresponds to
1.65 to 1.92 °E at 50 °C.

2.6. Shock-absorber Oil - Suspension Units

Shock-absorber oil WITHOUT ADDITIVES of the above viscosity is only used. The damping values of the telescopic fork and the spring-loaded suspension units are based on this viscosity. Springing and roadability will be impaired if shock-absorber oils of a different viscosity will be used.

2.7. Lubricant for Contact Breaker

"Unterbröl" special oil for contact breaker, viscosity 700 to 1,300 cSt at 50 °C.

2.8. Brake Fluid

For the disk brake, the brake fluid known as "Karipol grün" or - in countries other than the GDR - brake fluid SAE 70 R 3 or SAE J 1703 (for disk brakes) have to be used.

3. Disassembly of the Engine

The abbreviation "WoF" used below means width over flats of the tool (spanner) required.

3.1. Preliminaries

It is advisable, before starting the disassembling operations, to disconnect the battery and to remove it. During the repair period, it can be serviced. When the motor-cycle is kept in the workshop, the two fuses must be removed from the fuse strip under the right-hand panelling.

During the following work, the oil is allowed to drain from the gearbox (remove the oil drain plug (2) and unscrew the lower fastening screw (1) of the clutch cover).

NOTE: The gear-shift mechanism detent screw (3) does not serve for draining oil!

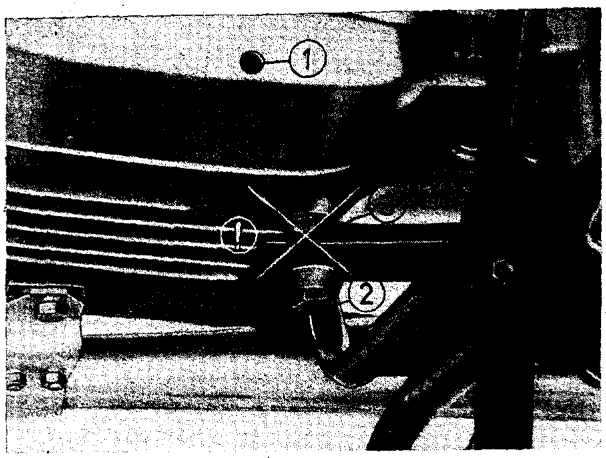


Fig. 6. Draining the lubricant from gearbox and clutch

3.1.1. Motor-cycle Right-hand Side

At the ringht-hand side of the motor-cycle, the operations for removing the exhaust system are started:

(1) Remove the union nut from the cylinder by means of a hook spanner,
(2) Remove the exhaust pipe clamp from the front of the engine (WoF 13),
(3) Take off the holding brace from the silencer rear (WoF 13) and
(4) the dynamo cover (hexagonal socket-head bolt WoF 5).

Fig. 7. Right-hand side of motor-cycle

After having pulled off the cables (1), unscrew the brush holder (2). After loosening the fastening screws (3), the stator can be removed. Using a box spanner (WoF 13), loosen the fastening screw of the cam of the dynamo. Sense of rotation of the spanner is opposite to the running direction of the engine. Then, the cam can be pulled off when slightly shaking the fastening screw (thread M 7).

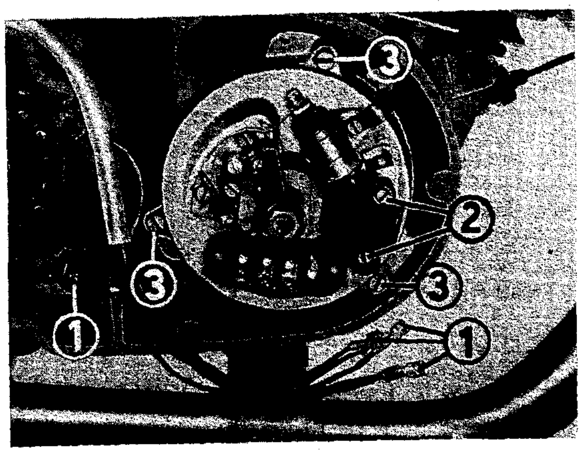


Fig. 8. Removing the stator from the dynamo

Extractor 02-MW 39-4(1) loosens rotor from cone of crankshaft (apply a blow with your hand on handle in the direction of rotation of engine). For the amateur constructor, a M 10 x 100 mm hexagon-head screw will do good service.

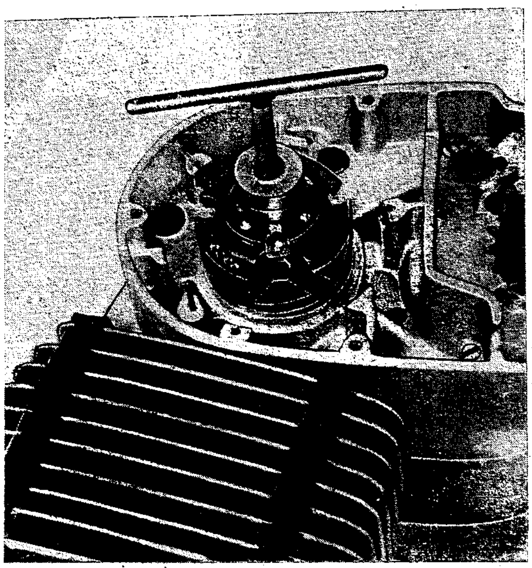


Fig. 9. Removing the rotor of dynamo

Open the secondary chain connecting link at front end of sprocket on drive shaft, using flat-nosed or combination pliers. Pull chain protecting hoses with chain from the engine towards the rear.

3.1.2. Removing the Carburetter

After closing the fuel shut-off cock and withdrawing the fuel feed hose, the carburetter can be dismantled.
Sequence of operations:
(1) Pull the protective rubber cap and unscrew starting carburetter actuation (WoF 14) under it
(2) Unscrew carburetter casing cap and draw it out with piston valve
(3) Loosen the clamping connection carburetter/induction pipe (screwdriver)
(4) Loosen two nuts (WoF 10) of the induction pipe connection

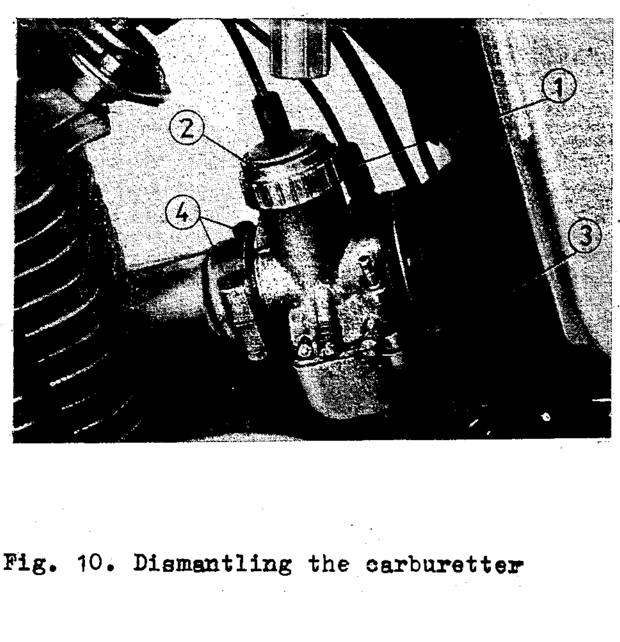


Fig. 10. Dismantling the carburetter

Pull the carburetter together with induction socket from the stud bolts at the cylinder, turn to the left and pull out of the induction tube (rubber).

3.1.3. Unhooking the Clutch Cable Control and Replacement

Remove protective cap (rubber) from casing of cable control holder (2), push along Bowden cable and take out the plug-type nipple.
Unscrew casing for cable control holder (2) from clutch cover (WoF 19) and push along cable for 5 cm, now the nipple (4) of the Bowden cable can be unhooked from the tie rod.
In the "deluxe model", the drive shaft for speedometer must be unscrewed before removing the engine

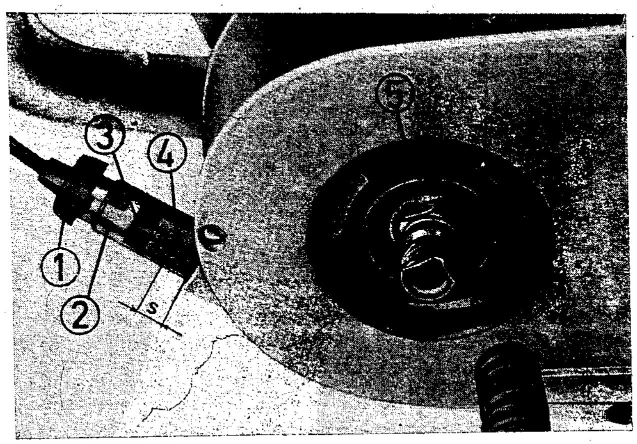


Fig. 11. Clutch cable control

3.1.4. Demounting the Engine

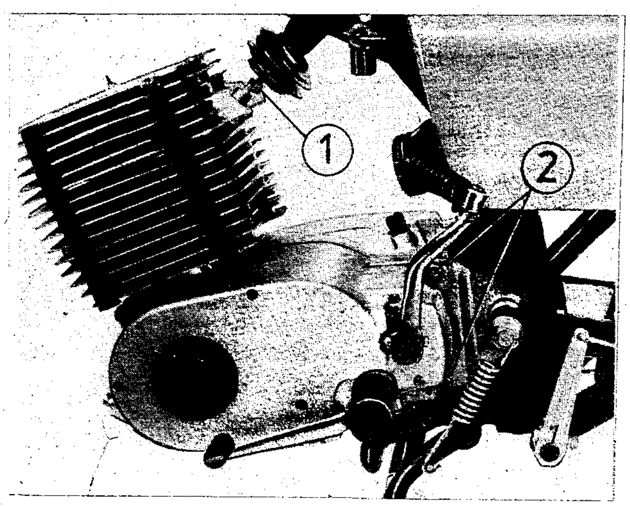


Fig. 12. Dismantling the engine or replacing the cylinder

Demounting the engine:

- Remove two nuts (WoF 13) (1) with washers from the studs of the cylinder head. Prop the engine from below;
- Unscrew the two fastening screws (2) from the rear engine shoes (WoF 13);
- After lowering the engine, draw it out in forward direction.

Replacement of cylinder:

The cylinder head, the cylinder and the elastic engine suspension can be changed in the position shown in Fig. 12.
For the replacement of the cylinder, the electric horn (1) and the fuel tank must be removed. For changing the fuel tank, see Section 5.4.

3.2. Dismantling the Engine

3.2.1. Preliminaries

It goes without saying that the demounted engine must be cleaned externally before it is dismantled. Naturally, all parts must be kept in such a way that no part will be lost or damaged.
Before mounting the engine in the engine assembly device, remove the front clamping screw (WoF 13) and the fitting sleeve under it by means of mandrel 11 MW 3-4.

3.2.2. Removing the Clutch Cover

After loosening the clamping screw with nut (WoF 10), remove the gear-shift pedal.
The kick-starter crank remains at the engine and is pulled off together with the clutch cover.
Remove the casing for the speedometer drive (2). Then demount the adjusting plate underneath and the drive gear for the speedometer (WoF 22).
After removing the 5 fastening screws of the clutch cover, alternately apply blows at points (3) by means of a plastic or rubber mallet and remove the clutch cover together with the kick-starter assembly.

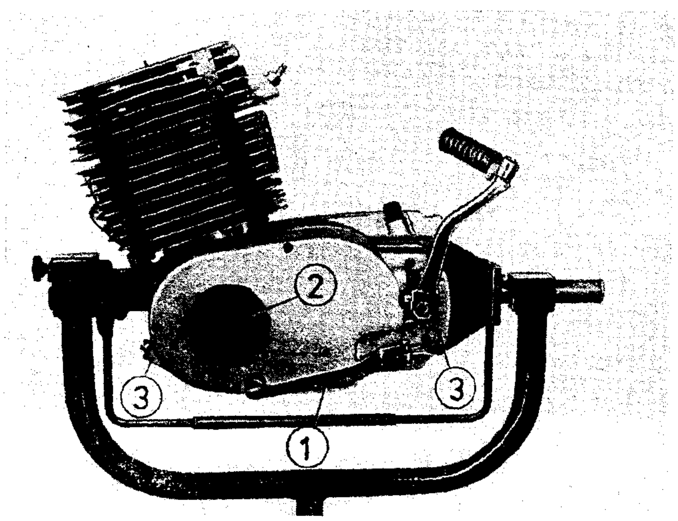


Fig. 13. Removing the clutch cover

3.2.3. Dismantling the Clutch and Primary Drive

Screw the clutch puller (1) fully on the thread of the clutch (2). The spindle (3) presses the clutch from the cone of the crankshaft. Pull the clutch from the internal driver. Remove corrugated washer (5) and thrust washer (4), remove drive gear with internal driver (3) and needle bearing (2) and spacer (1) from the crankshaft (see Fig. 21).

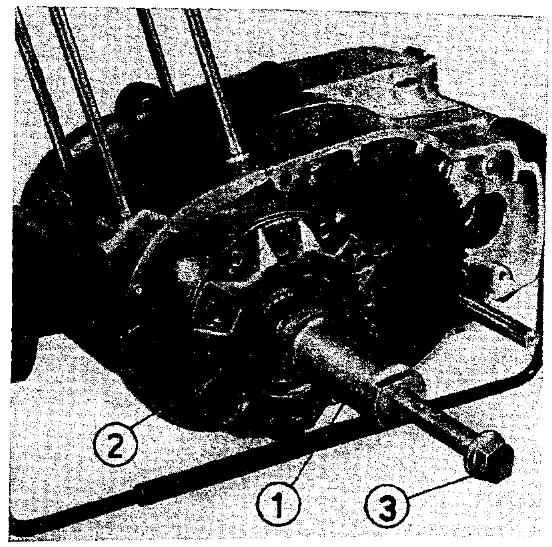


Fig. 14
Pulling off the clutch

After bending up the locking plate, by means of the assembling device (1) 22-50.430, block the drive gear and, using the socket wrench (2) (WoF 24), loosen the nut, unscrew it and remove the locking plate. The arrow-heads in the illustration show the fastening screws of the assembling device.

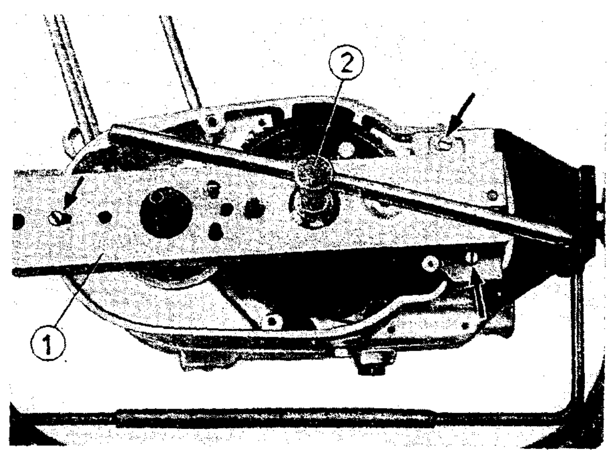


Fig. 15. Loosening the nut for the drive gear

Pull off the drive gear with 68 teeth by means of puller (1) 05 MW 45-3.

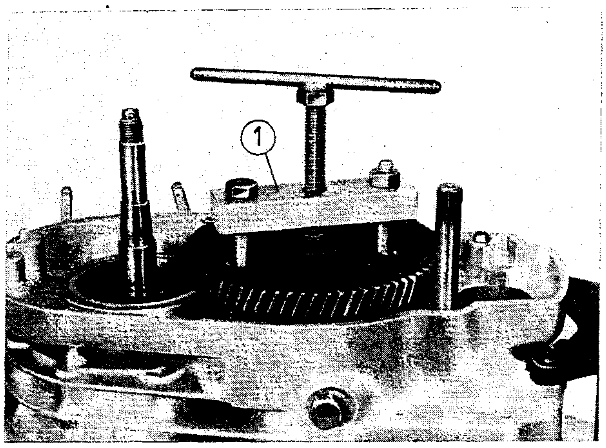


Fig. 16. Pulling the drive gear

Move the lock-lever (1) out of the drum cam (2), unhook tension spring (3) and remove it from guide bolt (4). Remove wire retaining ring (5) and snap ring (6), cap for drive shaft (7) and oil guide plate.

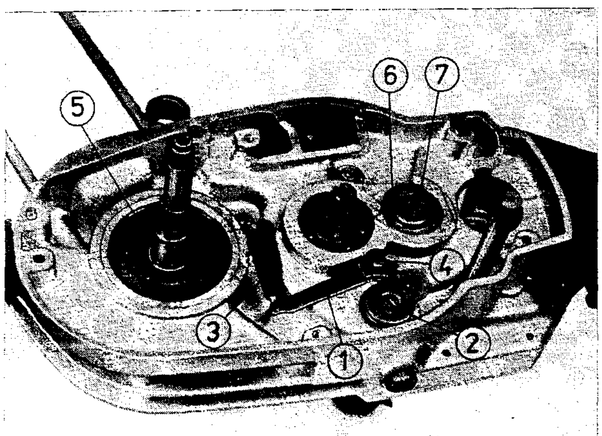


Fig. 17. Removing gear-shift detent and circlips

3.2.4. Dismantling the Kick-starter

Clamp the bearing collar of the kick-starter shaft between copper jaws or wood inserts in a vice (Fig. 84). Do not damage the thread of the splined bolt when driving out. To this end, loosen the nut M6 (WoF 10) only so far that it can be used as "thread protection". After removing the splined bolt, the kick-starter spring relaxes, the clutch voer turns to the right. Now, the complete kick-starter shaft can be drawn out of the clutch cover.

3.2.5. Dismantling the Clutch Actuating Mechanism

By turning clockwise, remove the pressure lever in the clutch cover from the worm of the bearing bush. Press the bearing bush out of the clutch cover (from the inside to the outside).
For the replacement of the supporting bearing 6302 of the crankshaft, remove the circlip from the bearing bush and press out the bearing.

3.2.6. Demounting and Mounting the Clutch

The assembly device 05-MW 150-2 (Fig. 18) enables the dismantling and assembling of the clutch. To facilitate work, it is clamped in a vice. Fig. 20 shows the mounting position.
For dismantling or checking the clutch, it must be so positioned that the pressure plate (1) is not put on the propping screws (2) (Fig. 18).

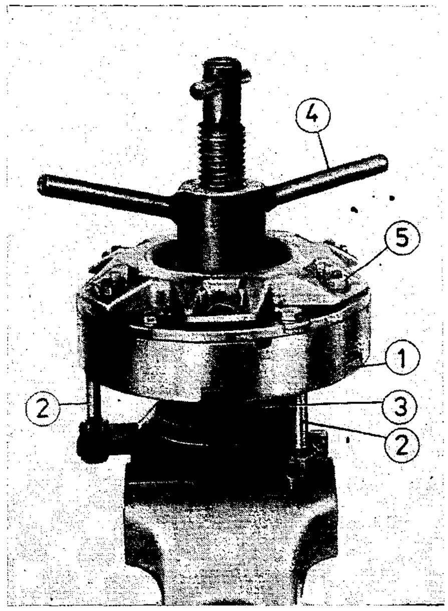


Fig. 18. Dismantling the clutch

For dismantling and assembling the clutch, the internal driver with drive gear (3) must be plugged on the assembly device.
By turning the lock nut (4) clockwise, the clutch flange is relaxed and the nuts (WoF 10) (5) can be loosened and removed with lock plates. After removing the lock nut (4), the clutch can be dismantled into its individual parts (Fig. 21). Checking for wear is dealt with in Section 3.4.1.

Sequence of clutch assembling (Figs. 19, 19a, 20, 21)

- Put internal driver with drive gear (3) on the assembling device (Fig. 19);
- Place the pressure plate with spacer bolt (6) on the supporting screws of the assembling device (Fig. 19);
- Put the gear ring (7) in place (Fig. 19);
- Alternately fit internal segments (8) and external segments (8a) (the parcel of segments is centred by the internal driver);
- Mount the clutch body (9), screw in the hexagon-head screws (11) with lock plates (10) and lock them (Fig. 19a);
- Place the spacer washers 00-18.196 (14a) on the spacer bolts (Fig. 19a);
- Put the compression springs (12) on the clutch body (9);
- Mount the pressure flange (13) and tension it with the upper part of the clutch assembling device. Adding the lock plates (10), fasten the pressure flange by means of the nuts (14) and lock them (Fig. 20).

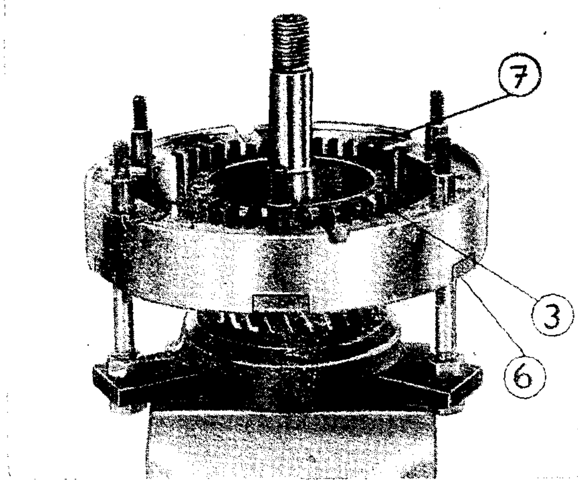


Fig. 19. Assembling the clutch -
1st phase

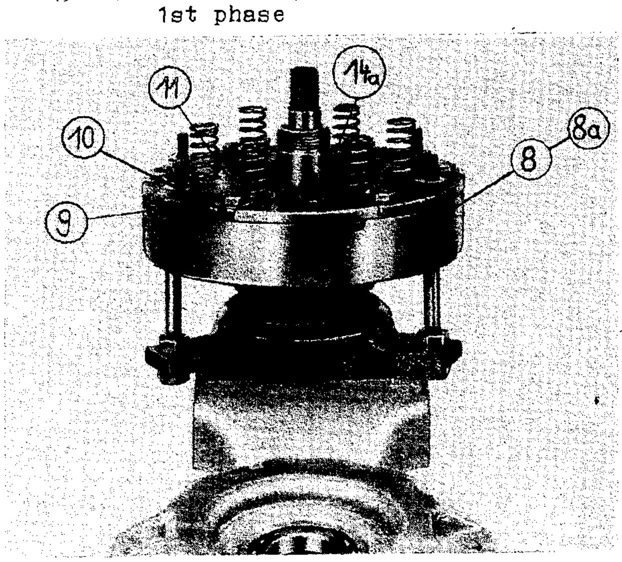


Fig. 19a. Assembling the clutch -
2nd phase

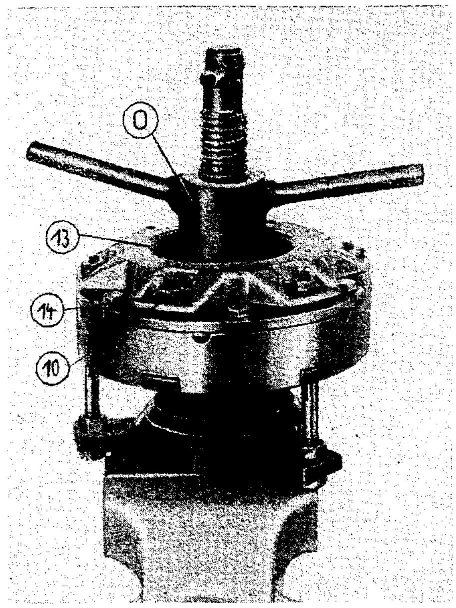


Fig. 20. Clutch - screwing the pressure flange in place

Functional test of the complete clutch in the assembling device:

The lock nut (4) of the assembling device (Fig. 18) is tightened by turning clockwise, it must be possible to turn the internal driver (3) with drive gear. The same test can be performed with the upper part of the 05-MV 150-2 assembling device with the clutch mounted in the engine.

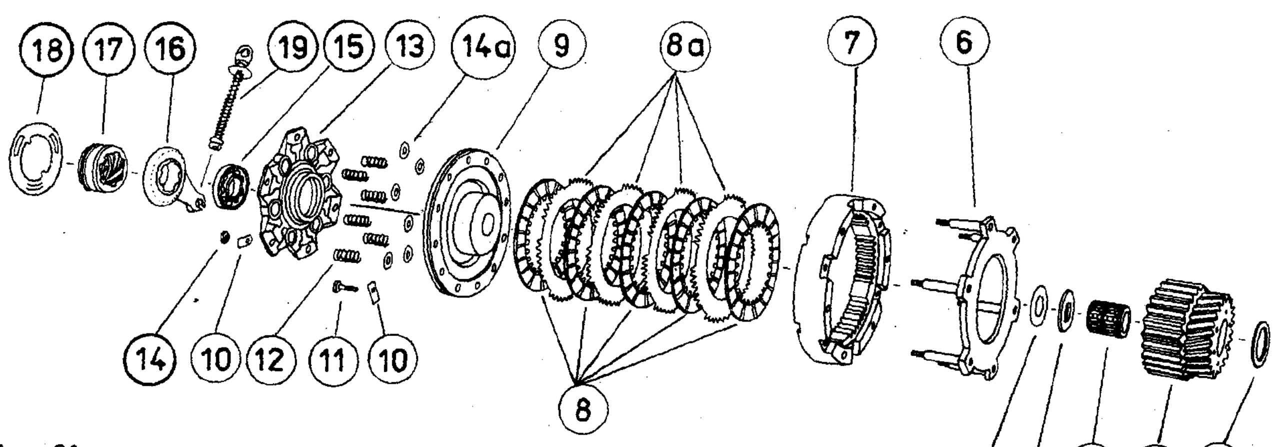


Fig. 21
Exploded view
of clutch

3.2.7. Demounting the Cylinder Assembly

Loosen the nuts (WoF 13) crosswise from the cylinder studs with a socket wrench, pull off the cylinder head and then the cylinder.

NOTE: When the engine is not dismantled, the opening of the crank compartment must be closed with a clean cleaning rag!

Press the gudgeon pin out by means of the pressing device (1) 22-50.010 and draw the piston from the connecting rod.

NOTE: Beating out the gudgeon pin is detrimental to the crankshaft and destroys the needle bearing on the pin!

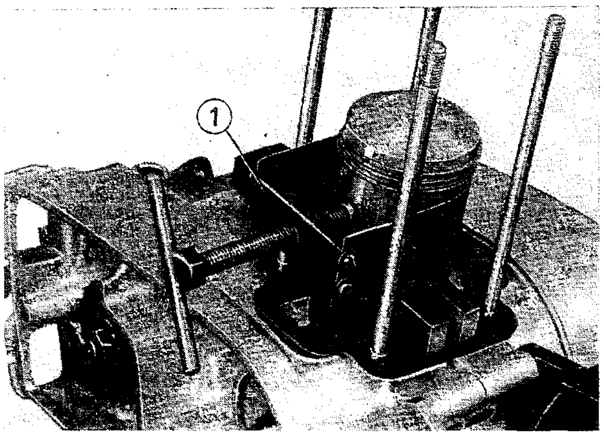


Fig. 22. Pressing out the gudgeon pin

3.2.8. Dismantling the Engine Dynamo Side

- Before loosening the nut of the sprocket wheel at the gearbox (WoF 24), bend up (1) the lock plate and apply the holding-up device (2) 05 MW 45-3 (right-handed thread).
  (3) = idling contact switch
- Pull the sprocket wheel from the gearbox. If this cannot be done manually, use the puller 05 MW 45-3.

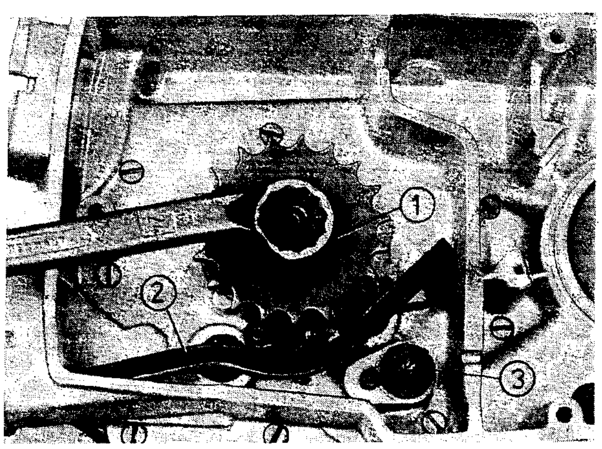


Fig. 23. Removing the sprocket wheel from the gearbox

- Unscrew the sealing cap (1), remove it with packing and take out the shims;
- Remove cylindrical roll (2) for armature detent and the wire circlip (3);
- Press out the rubber stopper (4);
- Loosen the housing fastening screws (14 screws) by means of a screwdriver and take out of housing;
- Open the locking handle of the engine assembling device.

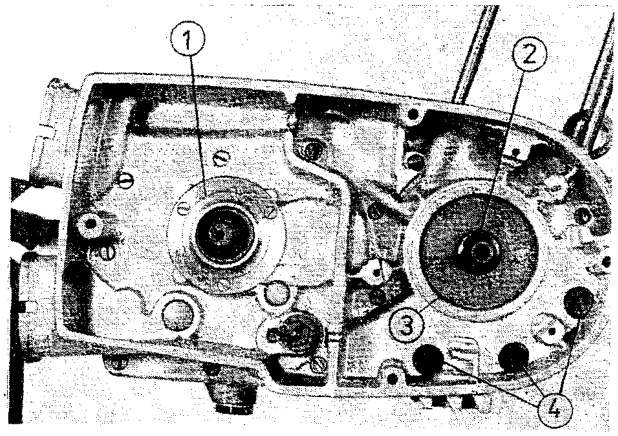


Fig. 24. Engine right-hand side

3.2.9. Separating the Two Housing Halves

The assembly bridge 22-50.430 is screwed on the right-hand housing half by means of two M 6 screws (1) (see Fig. 25).
By means of the spindles (2) of the bearing extractor 6203 and the clutch puller, the housing halves are separated by uniformly turning the pressure spindles.

NOTE: The use of other means such as screwdrivers, chisels etc. leads to the destruction of the housing!

Take off the right-hand housing half, clamp the left-hand housing half in the engine assembling device.

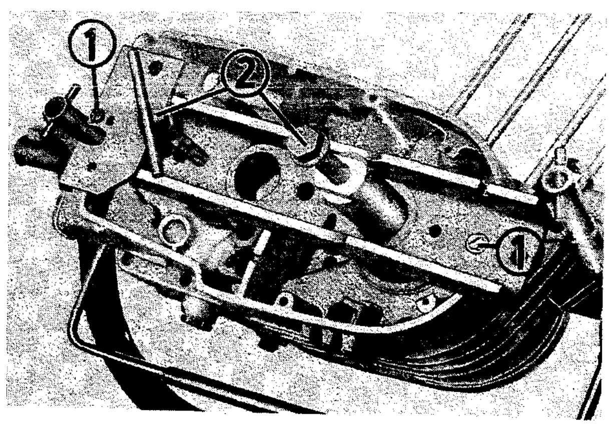


Fig. 25. Separating the housing

3.2.10. Dismantling the Gear-shift Mechanism and the Gearbox

(A) = driving shaft
(B) = driven shaft

Sequence of operations:

- Press the control arm (1) of the control member (2) out of the drum cam (3) in the direction of the arrow-head and pull the control shaft with control member (4) out of the housing;

NOTE: Do not damage the insulating disk (5) of the drum cam!

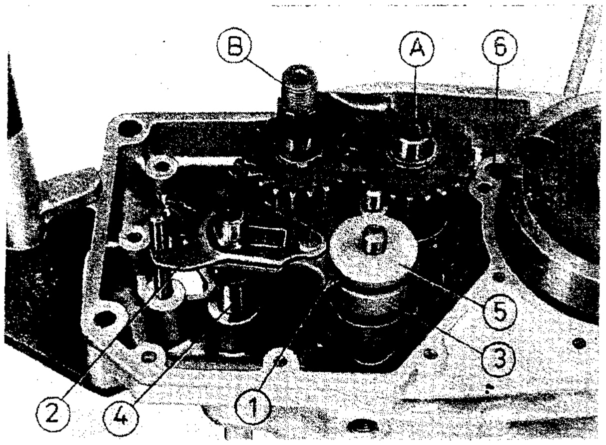


Fig. 26. Gear-shift mechanism and gearbox

- Remove the separating disk (6) (rubber) from the oil catch-pocket of the housing;
- Drive the driving and driven shafts out of their bearing seat from the clutch side by means of an aluminium, brass or copper mandrel. The gear-shift detent screw has been removed during a preceding operation.
- Pull the complete gearbox (driving and driven shafts, drum cam, guide bolt with selector forks) out of the left-hand housing half.

3.2.11. Pressing-out the Crankshaft

- Fasten the assembly bridge (1) 22-50.430 with the clutch puller (2) inserted on the clutch side of the left-hand housing half by means of the fastening screws (3) and (4).

NOTE: Before mounting the clutch puller, in any case place the pressure member (5) on the centring collar of the crankshaft (Fig. 28)!

- Press out the crankshaft by turning the pressure spindle (6) of the clutch puller clockwise; support the crankshaft with your right hand from below and retain it so that it cannot fall down when it leaves the bearing seat.

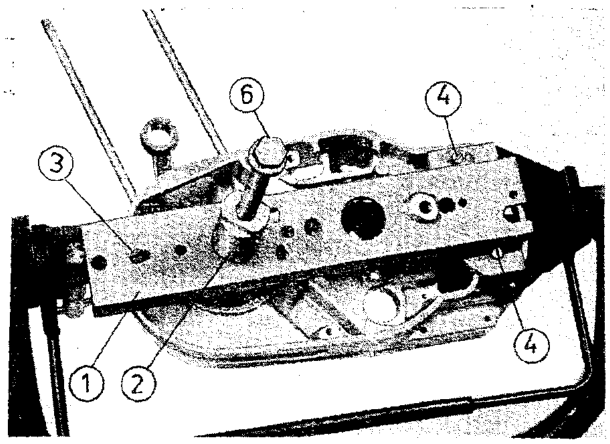


Fig. 27. Pressing out the crankshaft

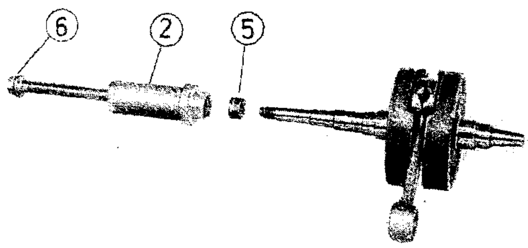


Fig. 28. Pressure member - demonstration

3.2.12. Dismantling the Gearbox Bearing

Before removing the ball bearings, the two housing halves should be heated to prevent damage to the bearing seats in the housing. The ball bearings are driven out by means of the drift 11 MW 7-4.

Left-hand housing half:

Remove the circlip of the 6204 bearing from the clutch side and drive out the bearing from the gearbox compartment.
Drive out the 6203 bearing from the outside towards the gearbox compartment (the circlip has been removed after the dismantling of the primary drive).

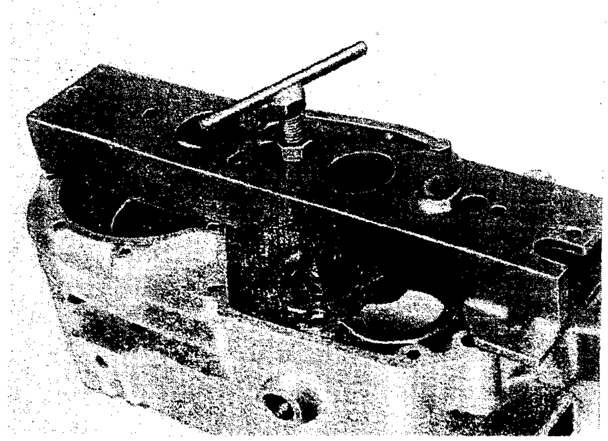


Fig. 29. Removing the 6203 bearing

Right-hand housing half:

Drive out the 6204 bearing from the gearbox compartment to the outside. Remove the 6203 bearing with pulling screw (1) and cartridge (2).

3.2.13. Pulling the 6306 Bearings from the Crankshaft

The crankshaft main bearings 6306 C 4 f are pressed off from the crankshaft by the ball bearing puller 22-50.431 (1). The two halves of the tool are applied between bearing and crank disk of the crankshaft, compressed in a vice and pre-tensioned with 2 screws M 8 x 100 (2). By screwing in two other screws with hardened pin at the start of the thread (3), the bearings are pressed against the crank disks of the crankshaft (Fig. 30).

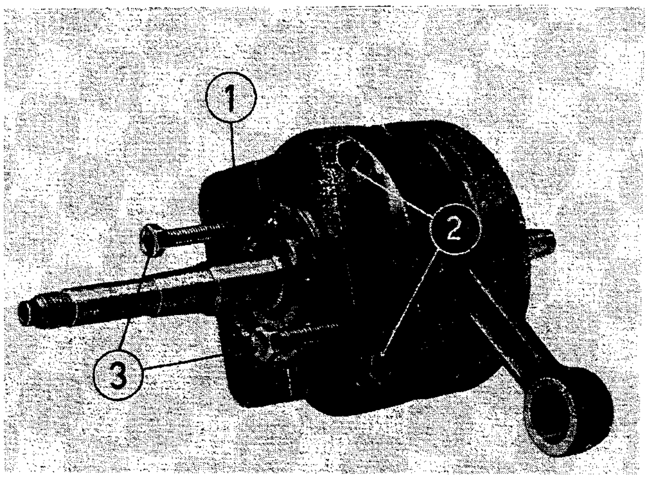


Fig. 30. Pulling the 6306 ball bearings from the crankshaft

3.3. Cleaning all Engine Parts

Before checking for wear, all engine parts are subjected to a careful cleaning process. The use of facilities and methods depends on the given possibilities.
In any case, perfectly clean, non-corroded parts must be available. Pay particular attention to the free passage of the oil ducts for the crankshaft main bearings in the two housing halves. Push wire through the oil ducts (1).

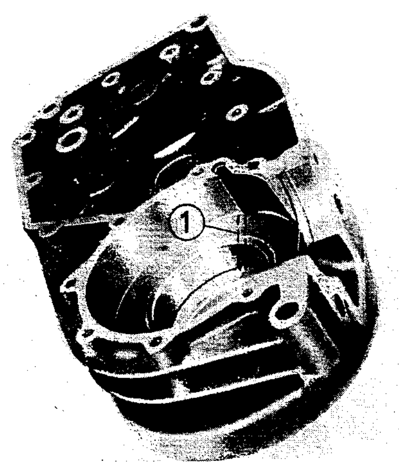


Fig. 31. Checking the oil ducts in the housing

Coked spots in the exhaust duct and transfer ports are cleaned in the cylinder. The combustion compartment in the cylinder head and the piston head must be cleaned with scraper and wire brush to remove carbonaceous oil deposits. After cleaning, these two surfaces must be bright and without scoring. In Section 3.4.3.4., information is given about the cleaning of the piston ring grooves.

3.4. Checking for Wear

3.4.1. Clutch and Clutch Operating Mechanism

POINTS OF WEAR:

- INTERNAL SEGMENT WITH FRICTION LINING

Wear is increased with incorrect clutch adjustment (no clutch lever clearance or clutch is allowed to slip excessively).
In extreme cases, the friction lining will burn away. When the clutch can no longer be readjusted and when it slips when the engine is accelerated, new segments must be mounted.

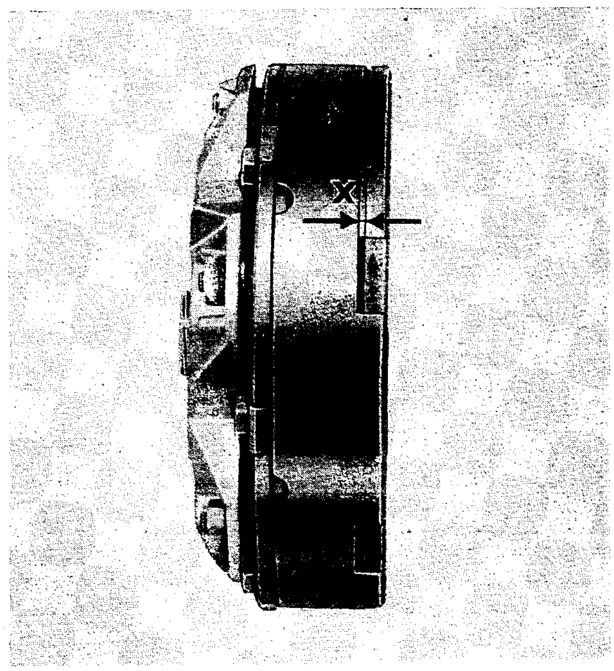


Fig. 32. Clutch wear value

This holds when the dimension "x" in Fig.32 falls below 0.5 mm. New segnments have a thickness of 3.0 mm ± 0.1 mm.
Wear value: -0.3 mm

- EXTERNAL SEGMENT

They must be replaced, when they have become blue - tarnished due to clutch slipping - (softened!) or are distorted.
Thickness in new state: $1.5_{-0.1}$ mm.

Deviation from plae condition of the surface is maximum 0.2 mm

- COMPRESSION SPRINGS

Their spring action may diminish, i.e. they relax. In severe cases, the clutch will slip even if all other compohents and the adjustment are in order.

Values in new condition:

Length, relaxed	28.3 mm ± 0.6 mm
Mounting length	17.0 mm
Spring force in mounted state	135 N (13.5 kp) ± 11 %

- DRIVE GEAR WITH INTERNAL DRIVER (Fig. 33)
  Check that the notched-pin connection between drive gear and internal driver is in order. When the notched pin connection is loose, the internal driver with drive gear must be replaced (re-riveting is useless!).

- TOOTHING - DRIVER and GEAR RING

  If noise is emitted when pulling the clutch, individual segments (external or internal segments) show increased play or backlash in the gear ring or internal driver and they will clash when the clutch pressure is relieved. The noise can be removed when fitting the segments to the gear ring and internal driver individually and replacing segments with excessive play.

- NEEDLE BEARING AND CLUTCH THRUST BEARING

  In the needle bearing for the internal driver, traces of wear will hardly be found, even after a longer period of operation.

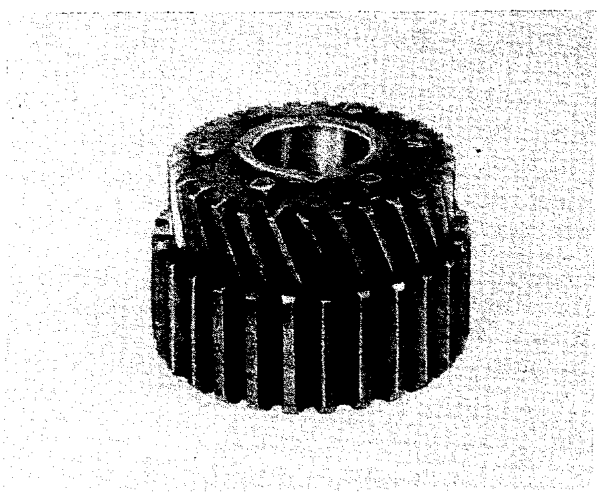


Fig. 33. Internal driver with drive gear

The clutch thrust bearing is caulked three times at uniform spacings at the outer ring, seated in the pressure flange (1). See to it that the outer ring of the thrust bearing does not turn in the pressure flange.

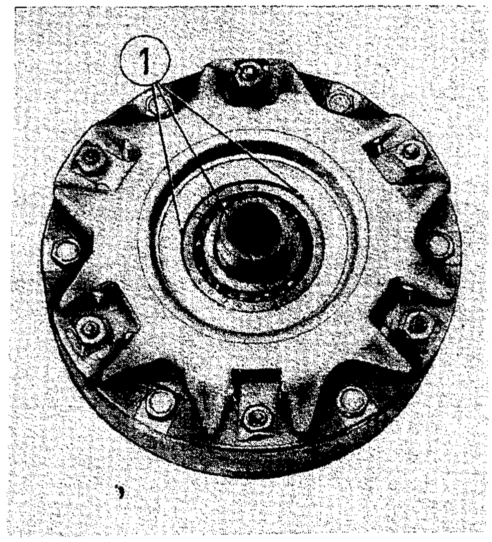


Fig. 34. Clutch thrust bearing

- CONE IN THE CLUTCH BODY

  The cone may be damaged due to the slipping of the clutch on the cone of the crankshaft because of incorrect mounting. In slight cases, the clutch body can be repaired by grinding with grinding paste on the cone of the crankshaft.

- PRESSURE LEVER AND BEARING BUSH (Fig. 35)

  Burr formation, points of pressure and sharp edges (1) at the teeth of the two components cause jerky engagement and disengagement of the clutch. These defects are removed by means of a suitable corundum stone or a special smooth cut file. Before assembling, put the two parts together and check that they are free to move easily.

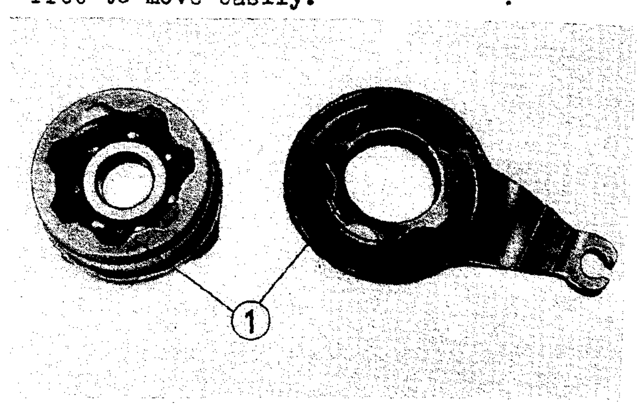


Fig. 35. Clutch actuating mechanism

3.4.1.1. Primary Drive

If there is excessive backlash between the drive gear (28 teeth) riveted to the clutch driver and the drive gear (68 teeth) to the gearbox, noise will be emitted when the engine is idling and in load change.

In new condition, the backlash is 0.036 mm to maximum 0.131 mm.

If the backlash is more than 0.25 mm, a new pair of spur gears must be mounted.

The radial play of the bearings 6306 and 6203 must be taken into account when measuring the backlash. The spur gears must be checked for damaged teeth.

3.4.1.2. Inevitable Wear on Kick-starter

Wear will mainly occur on the cam plate (1) if, during starting, the kick-starter is not fully kicked down. As a consequence, the engine will kick back and the cam plate will be destroyed due to the abnormal stress (distortion or breakage).

The distorted or broken cam plate causes a reduction of the distance (x) between kick-starter gear and driver in the mounted condition of the kick-starter shaft, and this leads to heavy wear on the teeth (2) of the two gears.

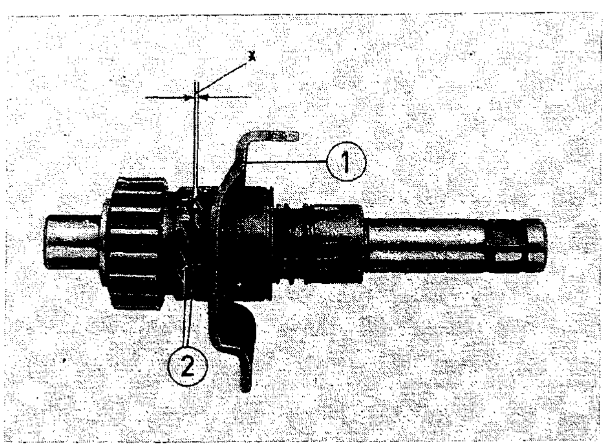


Fig. 36. Kick-starter shaft

3.4.2. Gears, Shafts and Selector Forks

The relief cuts in the claws at the control gears (on both sides) and the counter gears are arranged at an angle of 3°.

In the engaged condition (gear engaged), due to the wedge effect of the relief cuts, a force is produced which is designed to retain control gear and toothed gear (loose gear) in mesh.

Not only the gear-shift detent lever (1) (Fig. 17) keeps the various gears in the engaged state but also the wedge effect of the relief cuts contributes to this end.

When the claws of the control gears are heavily worn, the bearing surface becomes smaller and the gears jump out of engagement.

The selector forks must be checked for their angular condition; they must be perfectly at right angle to the guide bolt of the selector forks (90°). Slightly distorted selector forks can be straightened in a cold state, but great care must be taken.

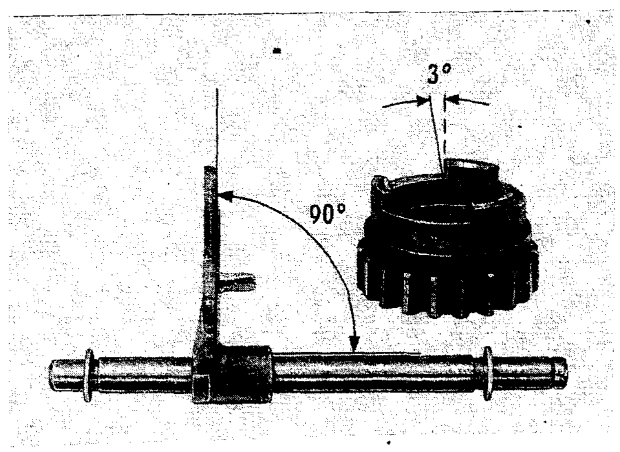
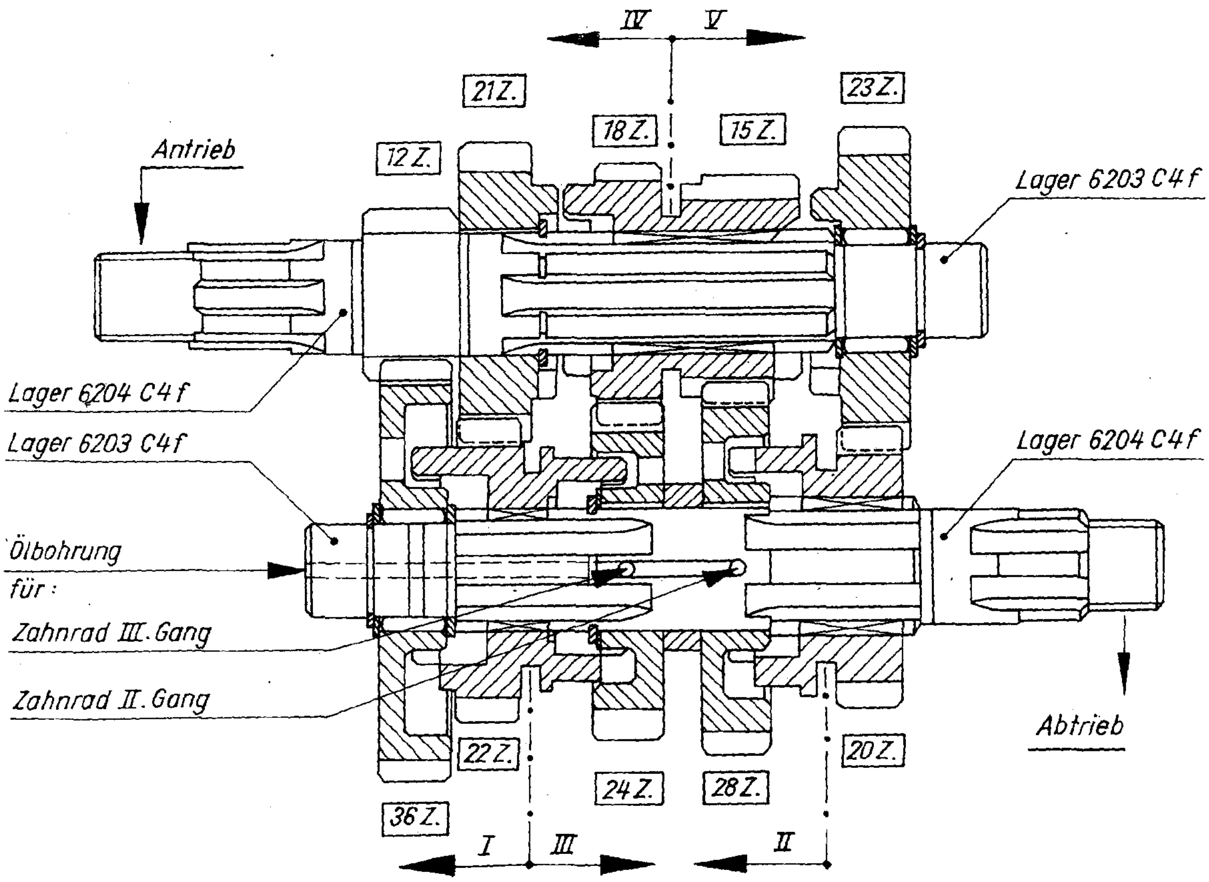


Fig. 37. Selector forks and claws

A selector fork not at right angle as described above will continually strike against the control edge and will be tarnished and become blue like the control gear. As a consequence, the hardened case will be lost and the two components become useless already after a short period of operation, hence, they must be replaced.
For a proper check of the gearbox, it is necessary to clean all parts carefully in order to perceive blue tarnished parts clearly.
The drive shaft must be checked for clean oil bores for the lubrication of the toothed gears for the 2nd and 3rd speeds (Fig. 38).
In general, tarnished, i.e. blue, gears, shafts and selector forks must be replaced by new parts in any case.



Antrieb = drive
Abtrieb = output
Lager = bearing

Fig. 38. Gear-shift mechanism

Ölbohrung für: Zahnrad III. Gang, Zahnrad II. Gang = Oil hole for: gear 3rd speed, gear 2nd speed

3.4.2.1. Gear-shift Shaft with Control Member and Control Stop

The control member must be checked that the control arm is free (1), (2) to move easily. The compression spring (3) must fit well in the countersunk bore in the gear-shift shaft. The same applies to the lock plates (4), (5), (6), (7). Dimension "a" is 16.6 mm. This section limits the angle of rotation of the gear-shift shaft (8). The return spring (9) has a long service life; it should be checked for cracks.

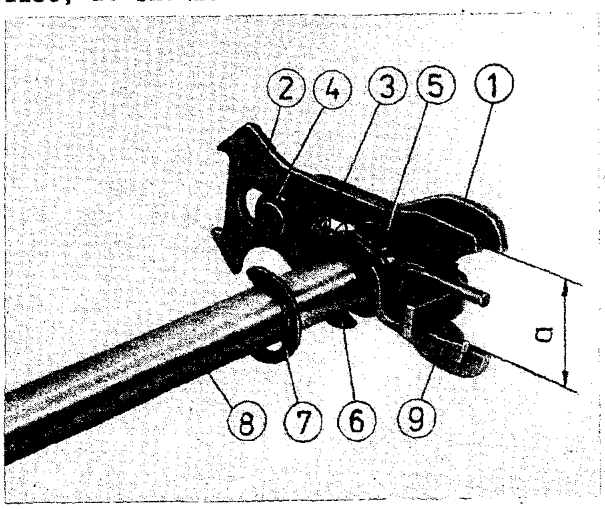


Fig. 39. Foot-operated gear-shift shaft with control member.

The cylindrical pin 8 x 80 (control stop) pressed into the housing, see Fig. 57, must not be loose or distorted.
The serration of the foot-operated gear-shift shaft will be destroyed when the foot-operated gear-shift lever is loose and will not be re-tightened. When the serration is severely damaged, the foot-operated gear-shift shaft with control member must be replaced.

3.4.3. Crank Assembly
3.4.3.1. Cylinder and Piston

When an engine output reduction occurs which is not due to wrong ignition timing, carburetter tuning, leaky shaft seal rings or clogged exhaust system (back pressure too high) while the dismantled piston is "black" round the entire piston skirt below the piston ring portion, then piston and cylinder must be replaced (compression and combustion pressure escapes between piston rings and cylinder wall).

In this case the cylinder liner (zone of port) shows a flare and immediately below the upper edge of the liner a collar can be felt.

Changing only the worn piston rings is useless in this case.

Replacement of the cylinder can be effected by mounting a new cylinder with piston or by regenerating the dismantled cylinder (this is more economical); for this purpose, the cylinder is reground after a new piston (taking the specified mounting clearance of 0.04 mm into consideration).
Pistons of the following oversizes are available:
69.50 mm; 70.00 mm; 70.50 mm; and 71.00 mm.

3.4.3.2. Control Measurement of Piston and Cylinder

In the new condition of piston and cylinder, the mounting clearance between cylinder liner and piston is 0.04 mm.
The wear limit is about 0.09 mm. Then a new or a replacement cylinder must be mounted because the noise increases with increasing mounting clearance (especially with load changes and when the engine is unloaded).
The nominal size of the piston is measured 30 mm above the piston lower edge. Only a new piston can reach the specified nominal size in a control measurement taking the measuring instructions into consideration. A piston that has already run is deformed. The cylinder must be measured in the lower and upper third of the liner by means of an internal measuring instrument. Without measuring instrument, wear can be identified by the edge (collar) about 8 mm below the upper edge of the cylinder liner.

3.4.3.3. Removal of Slight Piston Seizing

If the piston has been seized, in a slight case, the piston can be restored to proper working condition by finishing the points of seizure by means of a corundum stone soaked in a fuel-oil mixture.
Slight seizure marks of aluminium remains (caused by the piston) in the cylinder are removed by means of fine emery paper (grain 400) with every care. The retouching operation in cylinder and on piston must be carried out in longitudinal direction only.

NOTE: It is of no use to remove only the points of seizure and to leave the cause of jamming unchanged.

Below are a few examples of such causes:

- Lack of oil (no fuel-oil mixture but only fuel was filled up);
- Insufficient fuel supply and, hence, shortage of oil due to insufficient fuel feed from fuel tank to carburetter. Vent holes in tank cover clogged;
- Fuel filter cock clogged or fastening screws at handle excessively tightened (the handle must move easily);
- Basic carburetter tuning changed;
- Ignition timing wrong; consequently, overheating of the engine;
- Exhaust system changed, back pressure wrong;
- Air filter system defective;
- Engine takes in wrong air (mixture too lean in the upper engine speed range).

3.4.3.4. Piston Rings

Before used pistons are employed again, the piston rings and ring grooves must be subject to special care.



Fig. 40. Cleaning the ring grooves

Piston rings sticking in the grooves due to excessive or unsuitable oil in the fuel (petroil mixture) are carefully removed; they must not be expanded too much.
The carbonaceous oil deposit on the interior circumference must be removed and the ring grooves must be carefully cleaned by means of an old broken ring of the same type.

After this operation, the piston rings must be freely movable in the ring grooves.
The piston rings must not be exchanged; they must be fitted in the same groove from which they were taken.
Do not use oil when fitting the piston rings!

WIDTH OF THE RING GROOVES	
upper ring groove	$2.06^{+0.02}$ mm
central and lower ring groove	$2.04^{+0.02}$ mm
wear value	2.10 mm
THICKNESS OF THE PISTON RINGS	
all piston rings	$2.00^{-0.010}_{-0.022}$ mm
wear value	1.90 mm (maximum)

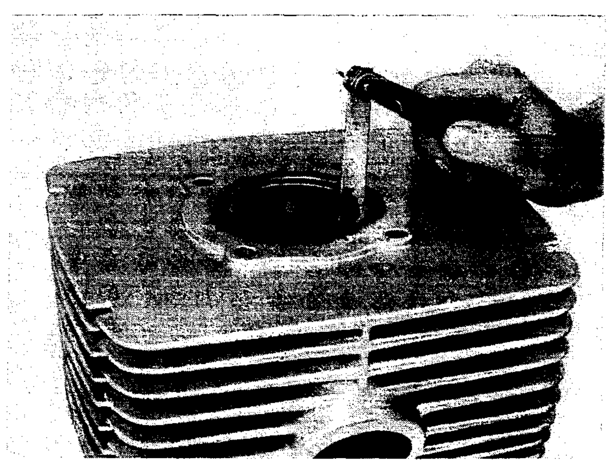


Fig. 41. Measuring the piston ring gap

Before fitting the piston rings, the state of wear must be checked. For this purpose, the piston ring is inserted in the cylinder liner, about 10 mm below the upper edge of the cylinder, and then the ring gap is measured. In new condition of the piston rings, the gap should be 0.2 mm.
When the ring gap is more than 1.6 mm, piston and cylinder are unserviceable.

When the arresting pins in the piston are loose (face of the pins is bright), or if they are missing, a new piston with cylinder (which may be ground) have to be mounted.

NOTICE: The edges of the ports must be chamfered otherwise awkward noise will be produced with the engine unloaded! Therefore, slightly chamfer the ports of newly ground cylinders!

3.4.3.5. Cylinder Head

When the cylinder head has become leaky - indicated by the oiled up upper ribs of the cylinder -, the cylinder head can be refinished on a surface plate by means of fine emery cloth (grain 400) to a limited extent, performing motions in a circle, unless there is a new cylinder head available.

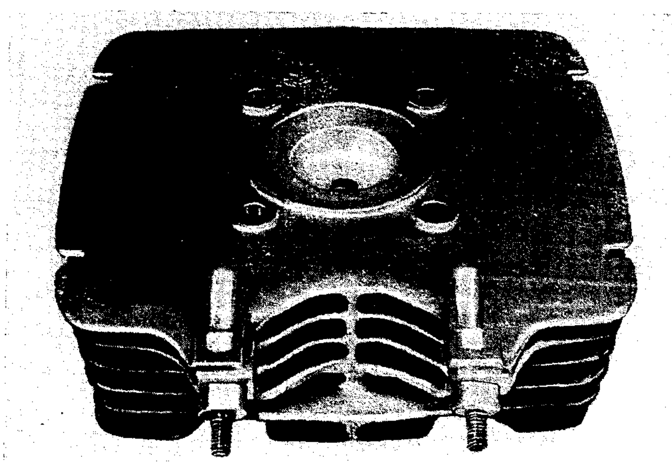


Fig. 42. Cylinder head - sealing surface and cumbustion chamber

When a cylinder head is leaky, an additional insertion of an aluminium shim is wrong. This will not be a remedy, the compression ratio will be changed and a further power reduction will be caused.

NOTICE: When demounting and mounting the cylinder head, take care that the fastening nuts are loosened and tightened uniformly and crosswise.

If this is neglected, the cylinder head will be subjected to particular stresses and become leaky.

3.4.3.6. Crankshaft

An inspection will show whether the collars of the sealing rings (1) are worn too much, whether the thread for fastening the clutch (2), the centring collar (3) and the thread for the anchor bolts (4), the cones for the clutch (5) and the anchor (6) are still in proper condition.

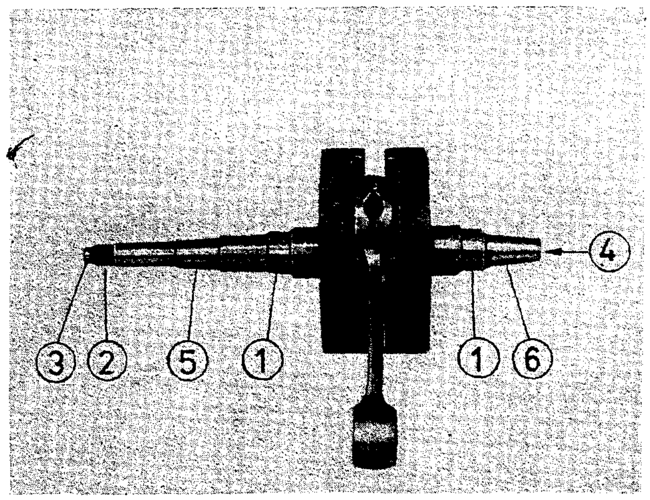


Fig. 43. Crankshaft

When defects found cannot be removed by refinishing, a new or a regenerated crankshaft must be mounted.

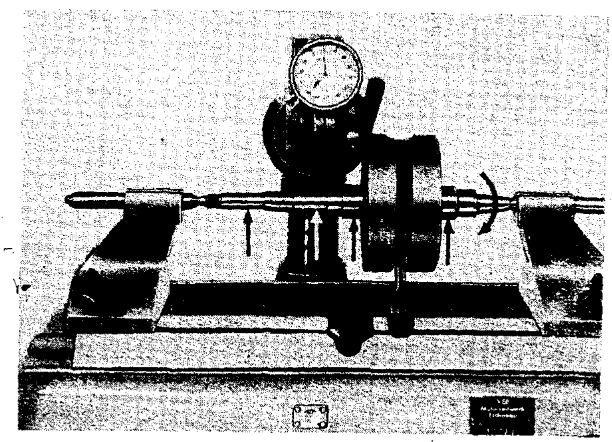


Fig. 44. Measuring the amount the crankshaft is out of true radially

Then the amount the crankshaft is out of true radially is measured at the points indicated in Fig. 44. For this purpose, the crankshaft is clamped between two fixed centres of a testing equipment or of a lathe.
The permissible amount is 0.03 mm. Greater values lead to ignition troubles at high rotational speeds, vibrating of the engine and leaky shaft seal rings.

The result is a poor engine output. A new crankshaft should also be tested because it may have been subject to transport damage.

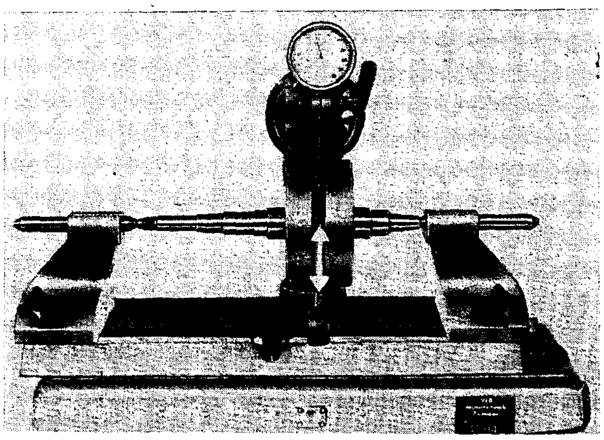


Fig. 45. Measuring the radial play of the connecting rod

Worn needle bearings in the big end and small end of the connecting rod are indicated by noise under load.
Measurement of the big-end boss is taken in the manner shown in Fig. 45. With the crankshaft in new condition, the radial play is 0.020 to 0.035 mm.
If the value is more than 0.05 mm, the crankshaft is worn.

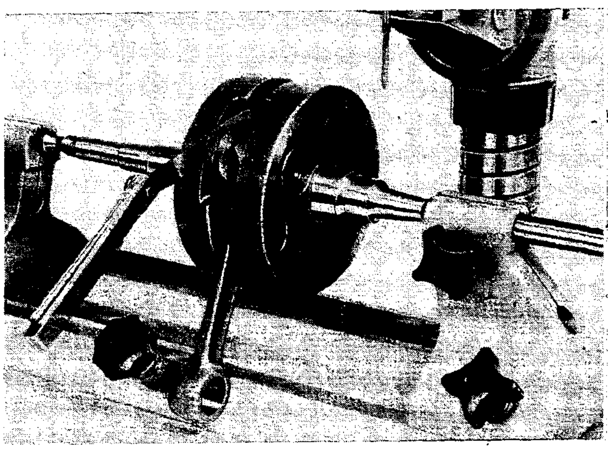


Fig. 46. Checking the axial play of the big-end boss

The condition of the bearing in the small-end boss, can only be judged subjectively by means of the conventional workshop equipment. The gudgeon pin must fit without any clearance in the conrod, and it must be possible to turn it without jamming while the resistance offered is just felt. Gudgeon pins showing signs of wear or a blue colour due to tarnishing are useless and must be replaced.
Axial play of the big-end boss between the crank disks is 0.170 to 0.563 mm.
Wear value: 1.0 mm.

3.4.4. Case and Packings

First and foremost, the sealing surfaces of the case must be checked. If they are damaged, they can be refinished in cases not too severe in the manner shown in Fig.42 for the cylinder head, using a surface plate and fine emery cloth.

Further checks in the case concern the bearing seats and the grooves of the snap rings; they must be in proper condition.

Bearing seats are useless when the bearings can be pushed by hand into the COLD case or on the bearing seat of shafts (with the bearing inner ring in a COLD state).

All paper packings are replaced by new ones in any case.

The shaft seal rings must be checked for fissures in the sealing lip, the wear and tension of the lip, further for the presence of the spring in the grooved provided for this purpose and the quality of the connection of the two spring ends. It is better to replace a shaft seal ring prematurely than to dismantle the engine once more a month later because of this relatively cheap part.

3.4.5. Radial Grooved Ball Bearing for Crankshaft and Gearbox

Defective crankshaft main bearings are identified by the characteristic engine noise and by the impossibility to set the contact breaker gap correctly.

The condition of the bearing tracks and the balls can be found by inspection after pressing the bearings with plastic cage apart. Worn bearings are damaged by pitting.

For bearings the rule also holds that after a prolonged period of operation of the engine all bearings should be replaced by new ones (on the occasion of a general overhaul).

The following bearings have to be used:

For the crankshaft, two 6306 C 4 f (plastic cage) as main bearings and one 6302 C 3 f as supporting bearing for the crankshaft in the bearing bush (plastic cage) have to be used.

In the gearbox, two 6203 J C 4 bearings,
one 6204 J C 4 bearing and
one 6304 J C 4 bearing

are mounted.

4. Assembling the Engine

4.1. Preliminaries

It is taken for granted that all engine parts are properly cleaned Defective parts were identified and rejected. The parts that are further usable were prepared for re-fitting. Before describing the assembly of the engine, we below give some instructions regarding the selection and mating of various units of construction.

4.1.1. Selection of Piston and Cylinder

The cylinder of the ETZ 250 differs from the cylinders used so far. In the cylinder, four transfer ports are arranged. The induction duct has a guide nose for the piston rings. The piston can only be used in the 69.6 design with a curve adapted to the new cylinder.

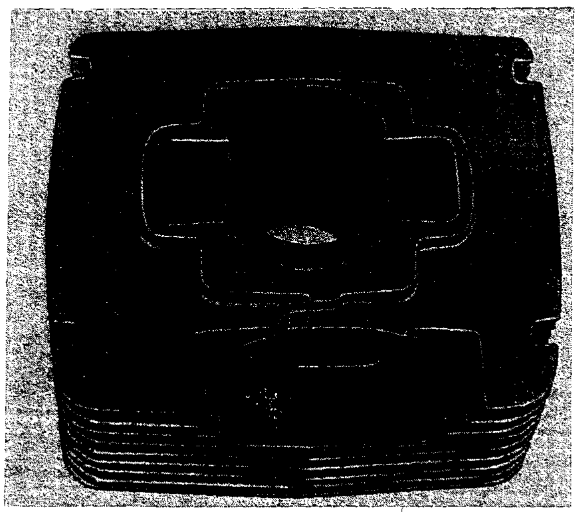


Fig. 47. Cylinder - lower sealing area

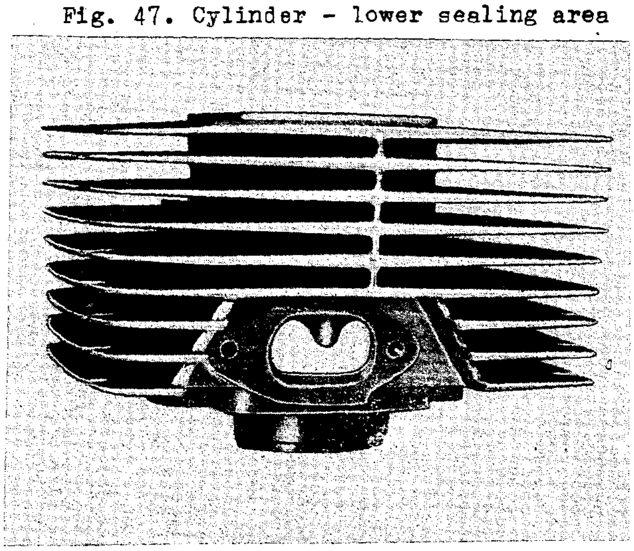


Fig. 48. Cylinder - induction part

A mounting clearance of 0.05 mm between piston and cylinder is specified. The following Table facilitates the selection of the parts to be mated.

Cylinder		Piston 69.6
Marking (Tolerance group)	Nominal size in mm	Nominal size in mm
1 ≙ - 1	68.99	68.94
0	69.00	68.95
+ 1	69.01	68.96
+ 2	69.02	69.97

This Table gives piston and cylinder dimensions in new condition which were procured by our Department Spare Parts Sale or which were mounted in our works.

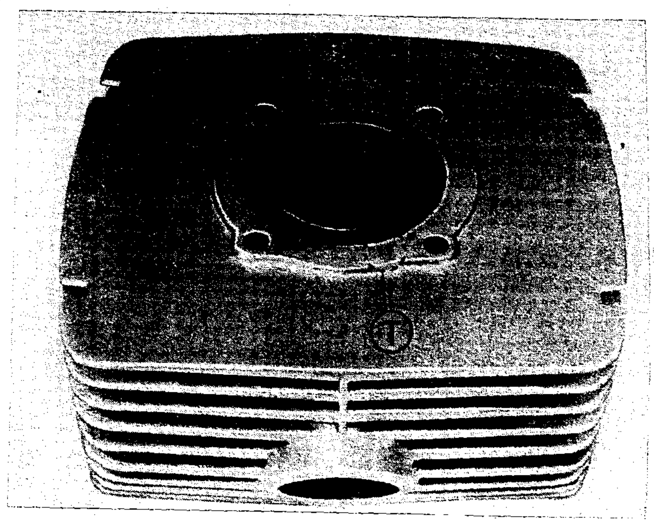


Fig. 49. Cylinder marking
T Tolerance group

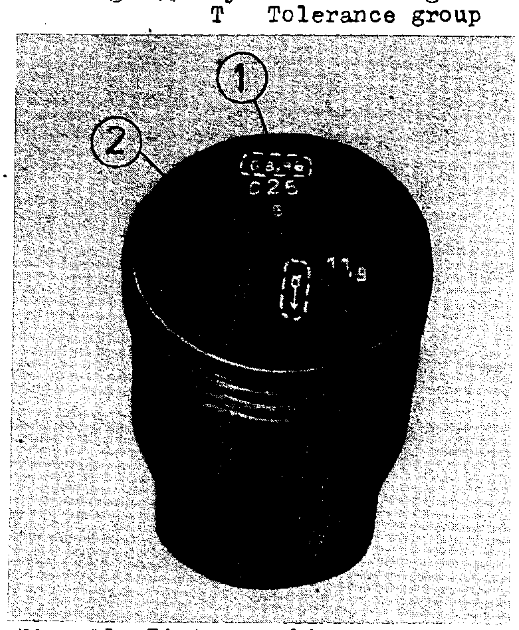


Fig. 50. Piston marking
(1) Nominal size in mm
(2) Mounting direction

4.1.2. Regeneration of the Cylinder

Each cylinder can be ground out for maximum 2.00 mm related to the basic size (69.00 mm).

Pistons in the oversizes of 69.50; 70.00; 70.50; 71.00

are available.

The cylinder is ground in the cylinder grinding shop according to the available piston and taking the specified mounting clearance of 0.04 mm into account; it is delivered in the mated state.

4.1.3. Selection of the Needle Bearing for the Gudgeon Pin (New Parts)

Needle bearings can easily be selected with the help of the Table shown in Fig. 51. This is only possible for new parts (crankshaft. piston and gudgeon pin and needle bearing). Pay attention to the fact that commercial packings of needle bearings are marked only with the mean dimensions (determined from upper and lower needle dimensional deviation). The bearings are not marked! Therefore, keep open packings separate.

When used gudgeon pin, piston and crankshaft are used further, then fit the needle bearing according to feel. (Colour marking canno be identified readily.) The gudgeon pin must be fitted without any clearance and it must be possible to turn it without jamming while the resistance offered to motion is just felt.

Kolbenbolzen 18 +0,0025 −0,0050	Pleuelbohrung = 22 +0,007 −0,016											
	Kennzeichnung gelb +0,007 bis +0,004		Kennzeichnung schwarz +0,003 bis 0		Kennzeichnung grün −0,001 bis −0,004		Kennzeichnung weiß −0,005 bis −0,008		Kennzeichnung blau −0,009 bis −0,012		Kennzeichnung braun −0,013 bis −0,016	
Kennzeichnung Toleranz in µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm
grün +2,5 0	0 −2	1,5 bis 11	−2 −4	1,5 bis 11	−4 −6	1,5 bis 11	−6 −8	1,5 bis 11				
weiß 0 −2,5	0 −2	4 bis 13,5	−2 −4	4 bis 13,5	−4 −6	4 bis 13,5	−6 −8	4 bis 13,5	−8 −10	4 bis 13,5		
schwarz −2,5 −5,0			0 −2	2,5 bis 12	−2 −4	2,5 bis 12	−4 −6	2,5 bis 12	−6 −8	2,5 bis 12	−8 −10	2,5 bis 12

Fig. 51. Table for bearing selection (dimensions in mm)

Toleranz in µm = tolerance in µm

Nadel-Abmaß = dimensional deviation of needle

Kolbenbolzen = gudgeon pin
Pleuelbohrung = conrod bore
Kennzeichnung = marking
Radialspiel = radial play
bis = up to

grün = green
weiß = white
schwarz = black
gelb = yellow
blau = blue
braun = brown

4.1.4. Bearings and Sealing Rings

For the gearbox, bearings with plastic cage are used.

2 x 6204 J C 4,
1 x 6203 J C 4 and
1 x 6304 J C 4

The crankshaft main bearings 6306 must be used in the sorted group C 4 f and the supporting bearing of the crankshaft in the bearing bush (clutch cover) in the sorted group C 3 f. As clutch thrust bearing, a grooved ball bearing 16 005 is fitted.
The shaft seal rings D 25 x 72 x 7 must be resistant to fuel and oil (only use original shaft seal rings).
The needle bearing for the clutch driver should be selected according to the following Table when a new driver is mounted.

Clutch driver (marking)	Needle bearing (mean deviation in mm)
yellow	-1; -2; -3; -4
black	-3; -4; -5; -6
green	-5; -6; -7; -8; -9

4.1.5. Pre-assembly of the Gearbox

All drive gears and needles of bearings must be fitted with engine oil.

4.1.5.1. Completing the Drive Shaft (A)

- Slip on the drive gear for the 4th speed (1) up to the fixed wheel (2), mount (3) thrust washer and circlip (4);

NOTE: Pay particular attention to the proper fit of the circlips in the grooves. Checking by striking the shaft on hardwood, keeping the drive gear (1) in one hand.

- Slip the control gear for 4th and 5th speeds (5) on the dirve shaft; take care that the side with the 18 teeth points to the drive gear for the 4th speed (1);
- Place a hardened and ground spacer (6) against the collar (start of the grooves). Two of these spacers are required on the drive shaft and two on the output shaft. They are exchangeable.
  Slip on the drive gear for the 5th speed (7) and fit the 24 needles (8) (2.5 x 11.8), then mount the spacer (6) and the circlip (9) (take care that the circlip is well seated in the groove).

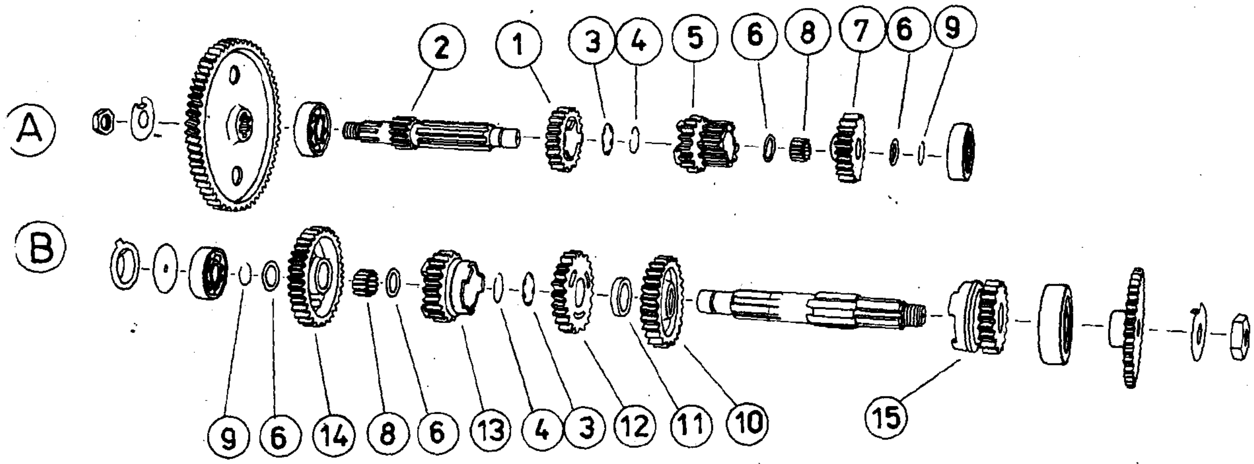


Fig. 52. Drive shaft (A) and output shaft (B)

4.1.5.2. Completing the Output Shaft (B)

- At first check the output shaft that the oil hole for the gears (window wheels) of 2nd and 3rd speeds are clean. The slip the gear for the 2nd speed (10) (28 teeth) on the shaft up to the collar of the groove piece, fit the spacer (11) and the gear for the 3rd speed (12) (24 teeth) is placed against the spacer;

NOTICE: Mount the gears (10) and (11) so that the flat side points to the spacer ring (11)!

- Put on the thrust washer (3) and the circlip (4);
- The control gear for the 1st and 3rd speeds must now be slipped on. The spacer (6) must be put against the collar of the groove piece and the gear for the 1st speed (14) (36 teeth) mounted. Fit the 24 needles of the bearing (8) (2.5 x 11.8) and mount the spacer (6) and the circlip (9);
- Put the control gear for the 2nd speed (15) on the opposite end of the output shaft.

4.1.5.3. Placing the Two Gear Shafts into the Assembly Container 29-50.011

- The pre-assembled gear shafts are placed into the assembly container. Flange-mounted gear shafts are not suited for the assembly container.

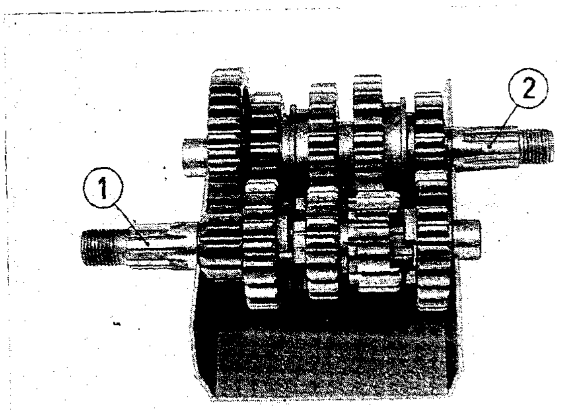


Fig. 53. Gearbox in assembly container
(1) Drive shaft
(2) Output shaft

- First insert the selector fork 011 (1) (central fork) into the control gear of 4th and 5th speeds (A = drive shaft). Then insert selector fork 010 (2) into the control gear for 1st and 3rd speeds and selector fork 012 (3) into the control gear of the 2nd speed (B = output shaft). Now the guide bolt (E) for the selector forks can be fitted (long collar pointing to the large gear for 1st speed (4), 36 teeth). Do not forget to fit the washers (5).
- Then the drum cam (C) is inserted into the guide bolt of the selector forks. The insulating disk (1) of the drum cam at the thin bearing pin must point to the side of the selector fork 012.
- Now the gearbox is ready for being mounted.

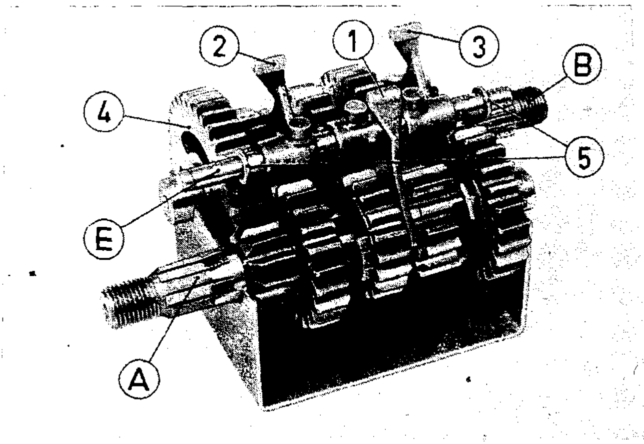


Fig. 54. Gearbox with selector forks

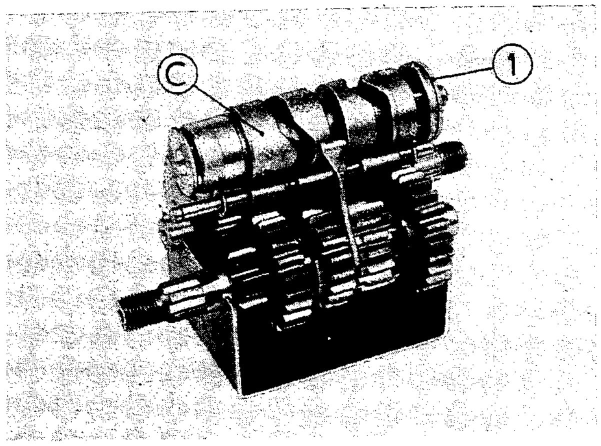


Fig. 55. Gearbox ready for being mounted

4.1.5.4. Preassembly of the Left-hand Housing Half

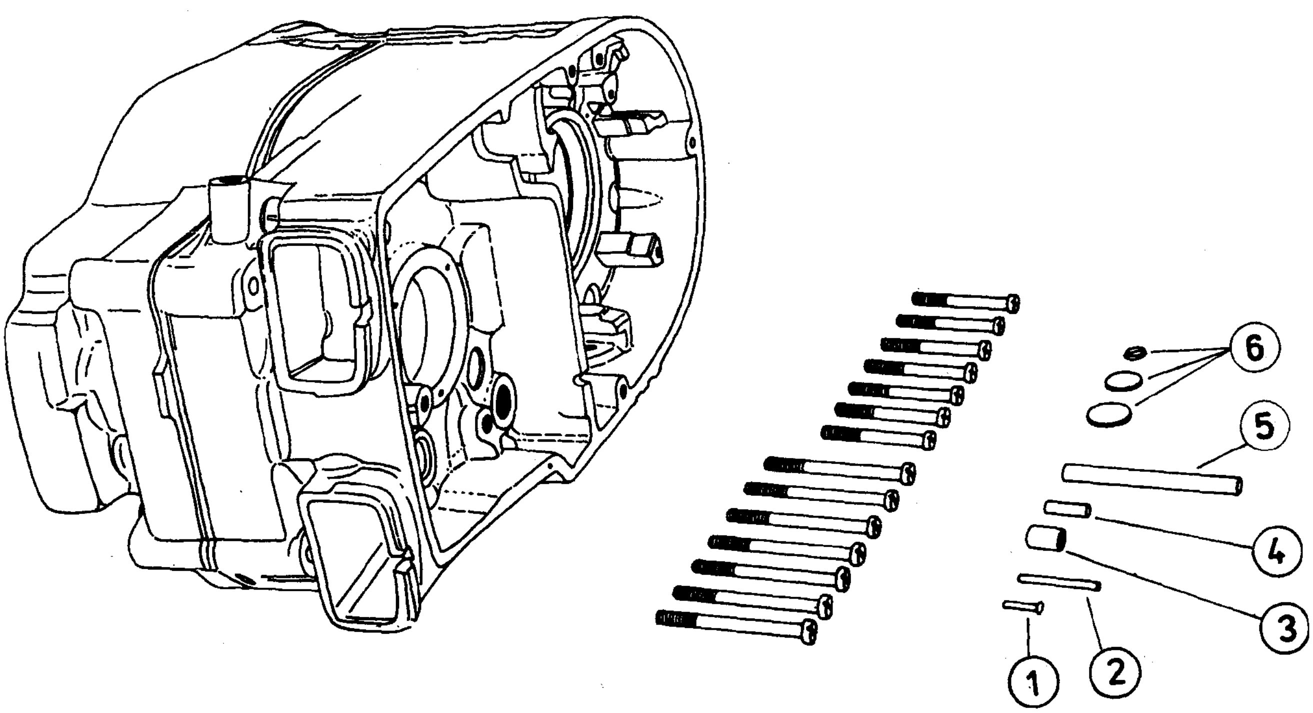


Fig. 56. Range of spare housings

If a spare housing, also known as casing, is used, it must be completed first. The parts shown in Fig. 56 must be mounted in the following way:

- Press the notched nail (1) for gear-shift detent spring into the left-hand casing half (clutch side);
- Press the notched pin (2) for fixing the position of the dynamo into the right-hand casing half;
- Press the fitting sleeve (3) and cylindrical pin (4) into the left-hand casing half at the clutch side;
- Press the cylindrical pin 8 x 80 (s), Fig. 57, for control stop, at a level of a = 57_{-1} mm measured from the sealing surface, into the cold casing;

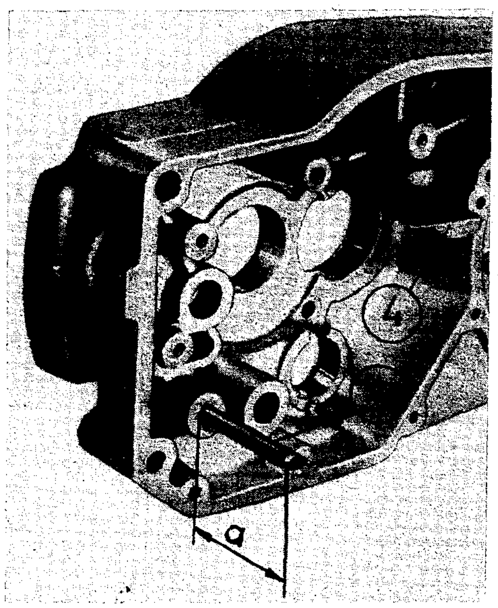


Fig. 57. Mounting the control stop and the oil guide plate

- Insert the oil guide plate (3 in Fig. 59) into the gearbox compartment and fit the locking plate at the clutch side, tighten the fastening nut M 6 and lock it;
- Press the closing plates (6) into the respective holes of the right-hand casing half from the dynamo side in such a manner that tightness is ensured.

When the old housing is further used, only the following operations have to be performed:

- Fit the inner circlip (1) for the crankshaft main bearing 6306 C 4 f (opening pointing to the oil hole - arrow-head a);
- Mount the circlip (2) for the gearbox bearing 6203 C 4 f (output shaft) into the housing. The opening of the circlip must point upward to the oil catch pocket (see arrow-head b);

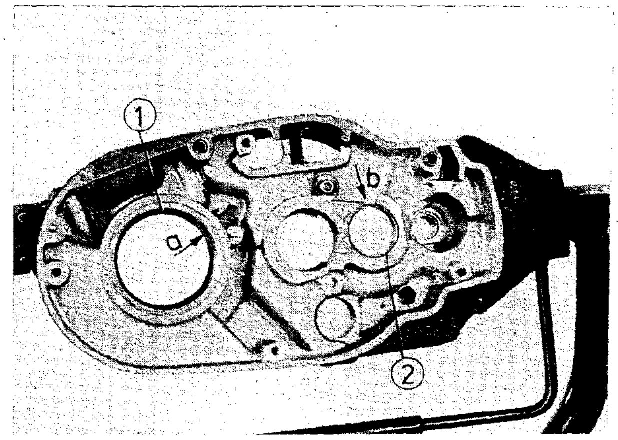


Fig. 58. Left-hand housing half

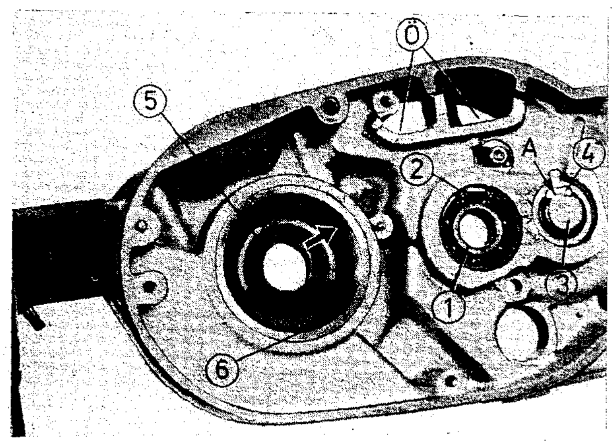


Fig. 59. Left-hand housing half - oil guide plate and gearbox bearing

- Heat the casing half to about 100 °C; no rubber parts must be mounted in the casing half;
- Starting from the clutch side, insert the gearbox bearing 6204 J C 4 (1) for drive shaft up to the casing collar and mount the circlip (2) on the clutch side;
- Starting from the gearbox compartment, mount cap (3) and seal plate (4) as well as gearbox bearing 6203 J C 4 for output shaft in this order.
- Put the oil guide plate (5) for bearing 6306 C 4 f on the circlip (6) from the crankcase interior. The dot pressed into the outer edge of the oil guide plate points to the opening of the circlip and serves as lock against displacement (see arrow in Fig. 59);
- Mount the crankshaft main bearing 6306 C 4 f (3) by means of the fitting mandrel (1) (29-50.405). At the same time, the oil guide plate is centred with the taper collar of the fitting mandrel (2);

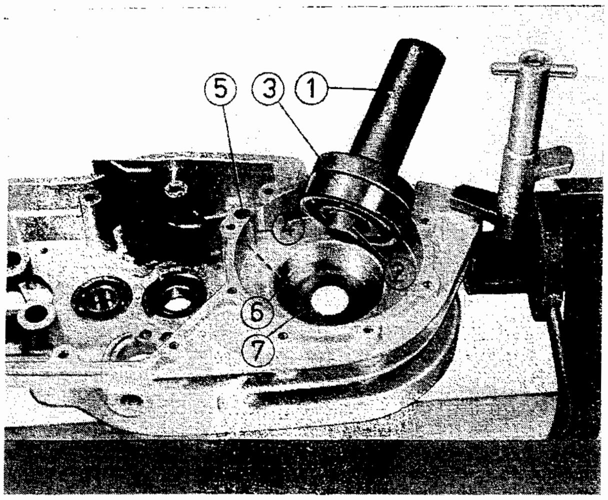


Fig. 60. Mounting the crankshaft main bearing

4.2. Mounting the Crankshaft, the Gearbox and the Foot-operated Gear-shift Shaft

- Heat the inner track ring of the 6306 bearing already in the casing by means of a heating mandrel (1 in Fig. 61);
- Insert the long crankshaft end into the heated inner track ring of the bearing and, without hesitation, allow it to slip into place up to the stop;
- If, due to hesitating in fitting or insufficiently heated inner track ring, the crankshaft jams, the latter can be properly fitted by means of the pipe (1) and the upper part of the clutch tensioning device (2) 05 MW 150-2. (The pipe is no special tool, sketch for self-construction is included in the Appendix);

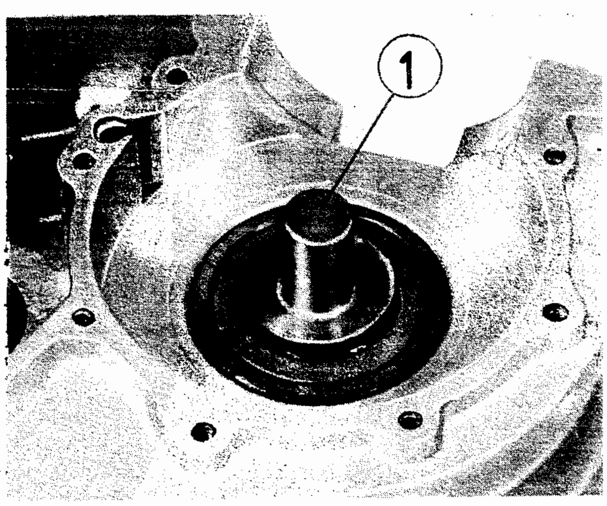


Fig. 61. Heating the inner track ring

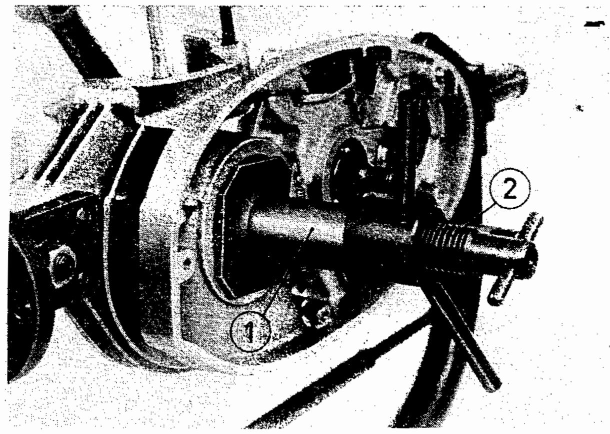


Fig. 62. Re-fitting the crankshaft

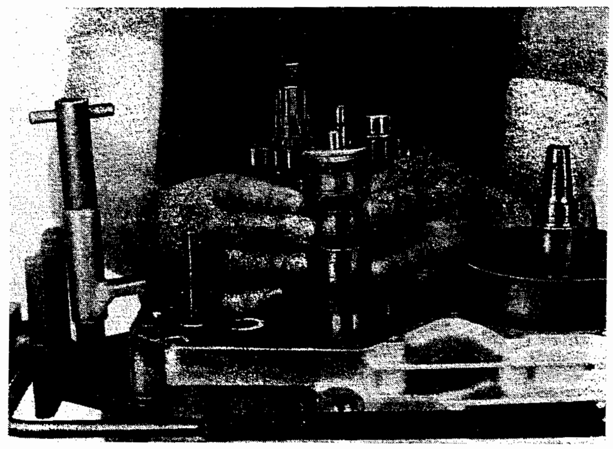


Fig. 63. Mounting the gearbox

- Take the preassembled gearbox out of the assembly container and put it into the left-hand casing half up to the stop.

  The long collar of the drum cam and that of the guide bolt for the selector forks must project from the clutch side when properly mounted (gear-shift position is of no consequence);

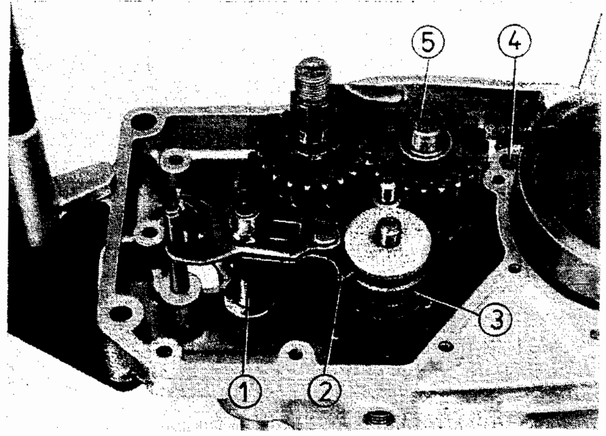


Fig. 64. Gearbox and crankshaft mounted

- Mount the foot-operated gear-shift shaft with control member (1), at the same time engage the control arm (2) with the drum cam (3);

  NOTICE: Do not damage the insulating disk of the drum cam!

- Put the separating plate into the oil pocket (4) of the crankcase;
- Heat the inner track ring of the gearbox bearing 6203 C 4 f and put it on the drive shaft (5);
- Slightly oil all bearings, shafts and bolts;
- Apply sealing compound to the sealing surfaces between the two housing halves; no sealing compound must get into the crankcase and gearbox compartment. The two casing halves are mounted without any packing.

4.3. Pre-assembling the Right-hand Housing Half

- During the preceding assembling work, the right-hand casing half has been heated to about 100 °C (on no account should the shaft seal rings be left in the housing because they become hard due to over-heating and thus become leaky in normal operation);

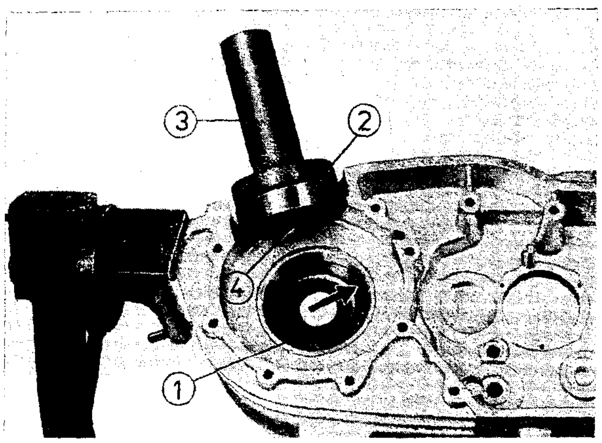


Fig. 65. Preparing the right-hand housing half

- Mount the inner circlip for the bearing 6306 C 4 f (opening to the oil hole);
- Place the oil guide plate (1) on the circlip. The flat side points to the outer track ring of the bearing, the depression (arrow) to the opening of the circlip;
- Fit bearing 6306 C 4 f (2) into the housing half by means of fitting mandrel 29-50.405 (3), at the same time, the oil guide plate is centred with the taper collar (4) of the fitting mandrel.

4.3.1. Mounting the Right Housing Half

- Heat the inner track ring of 6306 C 4 f bearing, mount casing half. When the casing half is heated to about 100 °C and the inner track ring of the 6306 bearing well heated, the casing half can be pressed, without tilting, on to the sealing surface. When this should fail, use a plastic or rubber mallet and apply slight blows to remove a tilted position;
- Use a drift 11 MW 3-4 and drife in the fitting sleeve to a depth of 26 to 28 mm in order that the two housing halves are centred;

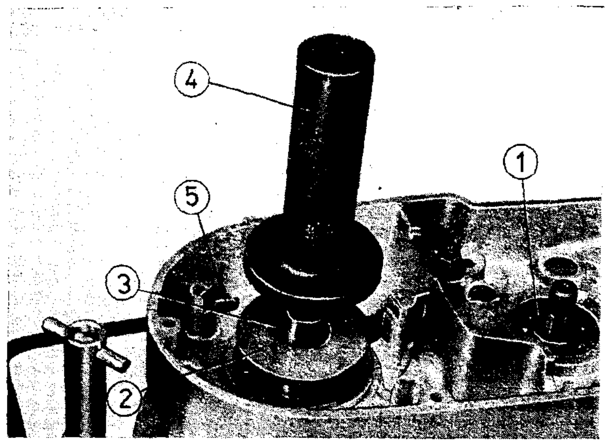


Fig. 66. Mounting the packing ring D 25 x 72 x 7

- Crosswise screw in 15 fillister-head screws to join the two casing halves;

NOTICE: On no account bolt the casing halves before driving in the fitting sleeve which centres the complete housing.

- Bearing 6304 J C 4 (1) for output shaft; heat its inner race and press it into right-hand casing half up to the stop with drift 11 MW 7-4;
- Measure seal cap and bearing seat, between collar of cap and bearing a clearance of 0.2 to 0.4 mm must be present. Compensate with fitting plates 40 x 0.1 (0.2; 0.5; 0.8) TGL 10 404-St;
- Mount sealing cap with packing, insert the countersunk screws with sealing compound;
- Mount the sprocket to gearbox. Tighten nut (WoF 24) with socket wrench and holder-up 05-MW 45-3 and provide with locking plate;
- Oil sealing lip of shaft seal ring (2) D 25 x 72 x 7 and press into dynamo side with fitting sleeve (3) and mandrel (4) 29-50.406. Lip points to bearing 6306.
- Mount circlip externally for shaft seal ring;
- Insert stoppers(3, of rubber) into holes (5) in dynamo compartment;

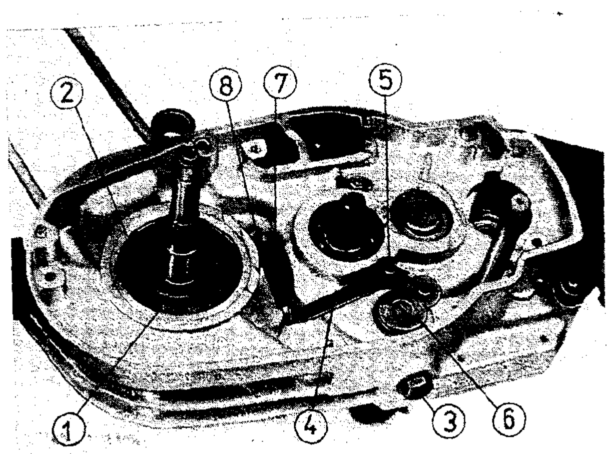


Fig. 67. Mounting the gear-shift detent

- Press the shaft seal ring D 25 x 72 x 7 (1) in the clutch side by means of mandrel 29-50.409 (prior to this, oil the sealing lip; it points to the clutch!);
- Mount the wire circlip (2) to lock the shaft seal ring;
- Screw the gear-shift detent screw (3) in place together with packing ring, compression spring and ball;
- Put the gear-shift detent lever (4) on the projecting guide bolt (5), engage it with the drum cam (6) and hook the tension spring (7) on the notched nail (8) (Fig. 67);
- While the casing is still hot, use a rubber or plastic mallet to apply blows on the bearings to release them.

NOTICE: Do not beat on crankshaft ends this will impair the true running of the crankshaft (0.03 mm)!

- Check the drive shaft and output shaft for ease of moving; the two shafts must run freely opposite to each other;
- Put the foot-operated gear-shift lever on the gear-shift shaft and shift all gears.

4.4. Mounting Piston, Cylinder and Cylinder Head

On selection and mating of piston and cylinder, information has already been given in Section 4.1.1.

This Section only deals with the correct mounting of piston and cylinder and the adjustment of the ratio of compression.

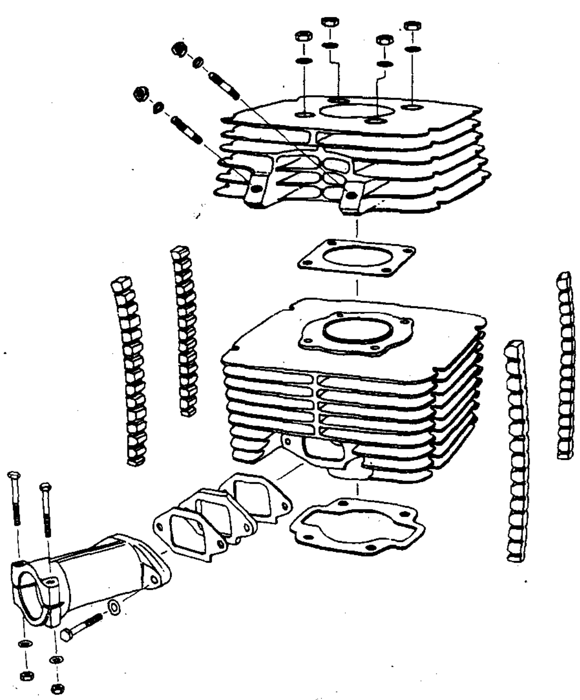


Fig. 68. Cylinder sub-assembly

Before assembling the cylinder check that bore (B) is closed. If this is not the case, insert a ball 4.5 mm in diameter, apply sealing compound to the threaded stud and screw it in place.

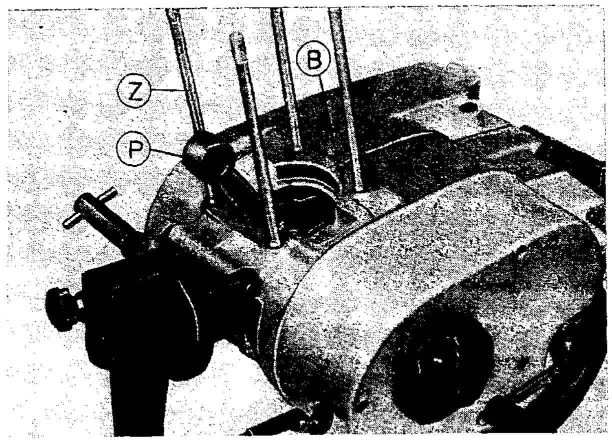


Fig. 69. Engine ready for mounting the cylinder

Check the cylinder studs (Z) for tight fit and apply engine oil to the needle bearing for the gudgeon pin and insert it into the small-end boss (P).

Close the crankcase with a clean cleaning rag until the cylinder is mounted in order that no foreign particles (lock ring for gudgeon pin) can get into the crankcase.

4.4.1. Piston and Cylinder

To facilitate mounting, the piston is heated to a temperature of about 40 to 50 °C on an electric boiling plate. Before mounting, make sure that piston and gudgeon pin show the same colour marking.
While the piston is heated, place the cylinder foot gasket on the sealing surface of the casing.

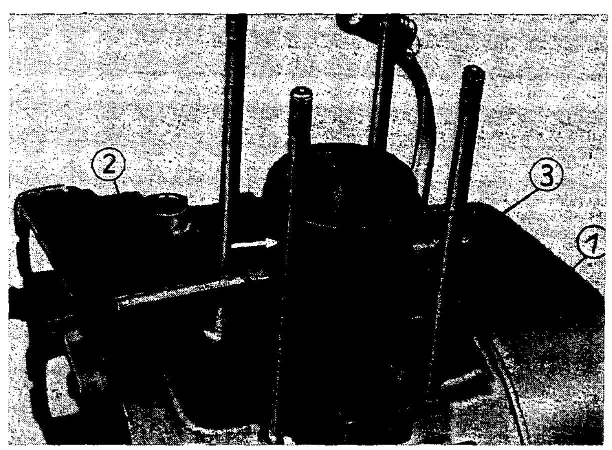


Fig. 70. Mounting the piston

Place the piston support (1) 22-50.412 on the casing and put the piston, which is heated, over the conrod with the arrow pointing to the exhaust port. The cold gudgeon pin (2) is put on the cold guide mandrel (3) 05-MW 19-4 and the mandrel with the taper ahead inserted into the piston. Thus, piston and conrod are aligned and the needle bearing protected.
The gudgeon pin must be inserted quickly and without interruption so that the raised temperature of the piston cannot be transmitted to the gudgeon pin because the latter would then expand and jam in the piston.
A gudgeon pin that got stuck has to be re-pressed by means of the pressing-out device 22-50.010 only. Beating with hammer and drift leads to a deformation of the piston.
The two new snap rings (S) are inserted by means of taper-nose pliers; check that they are properly seated in the grooves of the piston.

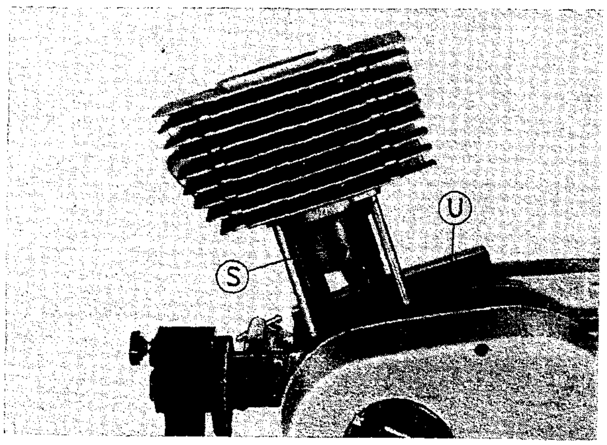


Fig. 71. Mounting the cylinder

Turn the piston rings so that the locating pins are between the ends of the rings (Fig. 70, long arrows) otherwise the piston rings will jam in the cylinder and break when the cylinder is mounted.
With the cylinder liner slightly oiled, push the cylinder over the piston. The piston support (U) 22-50.412 props the piston. It is removed as soon as the cy - linder fully covers the piston. Then fit the cylinder completely.

4.4.2. Cylinder Head and Ratio of Compression

The engine emits a peculiar sound when the compression ratio ε = 10.5 : 1 is exceeded. Falls ε below 10.5 : 1, the engine fails to reach its full power.
With the correct ratio of compression, the combustion chamber has a volume of about 26 cm^3.
The dimension of the gap is 0.9 to 1.2 mm. Fig. 72 shows how measurements are taken. A lead wire - commercial solder wire 2mm in thickness will be suited best - is inserted into the combustion chamber through the sparking-plug bore. The piston moving through the T.D.C. presses the lead wire flat. By means of a vernier caliper or a micrometer screw, the dimension of the gap is determined by measuring the flattened wire.

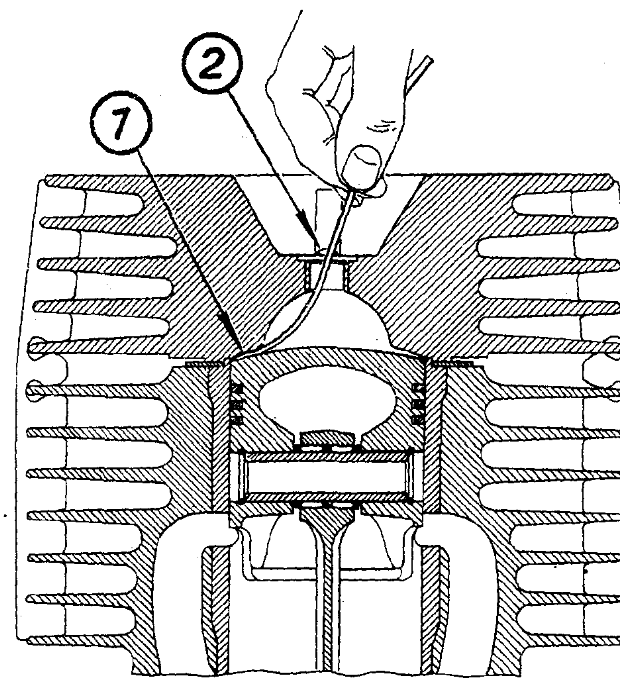


Fig. 72. Determining the dimension of the gap

For each measurement, the cylinder head must be fastened by means of at least two nuts arranged crosswise.
(2) = drain hole.
Shims (A) in the thicknesses 0.2 mm and 0.4 mm enable a correction of the gap. Please, only use original shims of aluminium, and replace them by new ones when the cylinder cover has been demounted.
One shim (minimum 0.2 mm) at least must be fitted.
On top of the cylinder liner, a collar (B) of 1.5 mm is turned in a lathe, see Fig. 73, which centres the shims and prevents that the temperature of combustion directly contacts the aluminium shims.

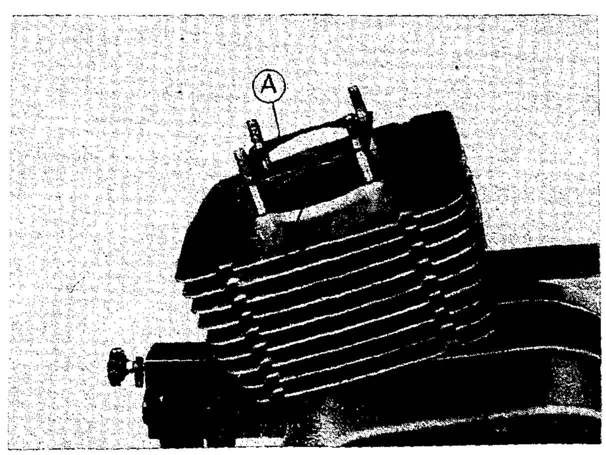


Fig. 73. Fitting the shims

After having determined the dimension of the gap, the new shim found in this way is placed over the centring collar (B) on the cylinder.

Mount the cylinder head and gradually tighten the nuts crosswise by means of a socket wrench with a torque of 26 Nm (2.6 kpm).

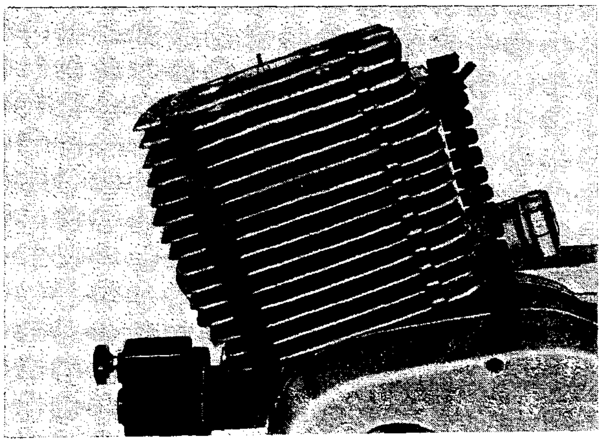


Fig. 74. Mounting the damping combs

Finally, press the four damping combs (D) into cylinder and cylinder head.

4.5. Mounting the Primary Drive

4.5.1. Drive Gear for Gearbox (68 teeth)

- Put the drive gear on the drive shaft; the recess for engaging the locking plate must be visible;
- Fit the locking plate and, using a nut M 16 x 1.5, tighten up to the collar of the drive shaft. For arresting the drive gear, the holder-up 22-50.413 or the assembly bridge 22-50.430 (1) and a socket wrench (2) (WoF 24) is to be used (see Fig. 16).

  Torque for tightening: 80 to 100 Nm (8 to 10 kpm).

NOTICE: An insufficiently tightened drive gear causes considerable noise when changing the load on the engine.

4.5.2. Clutch Driver (see Fig. 21)

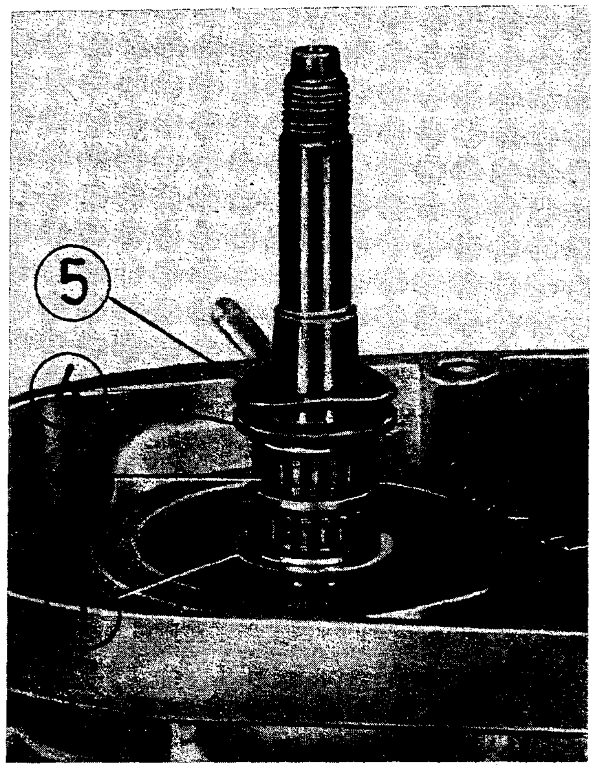


Fig. 75. Principle of mounting the clutch driver

- Spacing plate (1) 1.90 mm, 1.95 mm or 2.00 mm in thickness;
- Set of needles (2) KK 22 x 26 x 26;
- Clutch driver (3);
- Thrust washer (4) 2.3 mm in thickness;
- Spring lock washer (5).

Put these parts in the above order on the end of the crankshaft (clutch side); the spacing plate and the thrust washer must be placed so that the relieving of the hole points to the collar of the crankshaft.

NOTICE: The set of needles (2) is available in tolerance groups (see Section 4.1.4.)!

The permissible radial play of the inner driver with drive gear (3) is 0.004 to 0.029 mm.

For fitting observe all that has been said with respect to gudgeon pin needle bearing (see Section 4.1.3.), and apply engine oil to the bearing when fitting.

4.5.3. Measuring and Adjusting the End Play of the Clutch Driver

The given end play is determined by means of the measuring device 05-ML 13-4. For this purpose, the measuring device is fitted without spring lock washer (5) and thrush washer (4) (Fig. 75). When moving the inner driver axially, the end play is indicated by the dial.
The end play of the drive gear with inner driver is 0.05 to 0.10 mm.

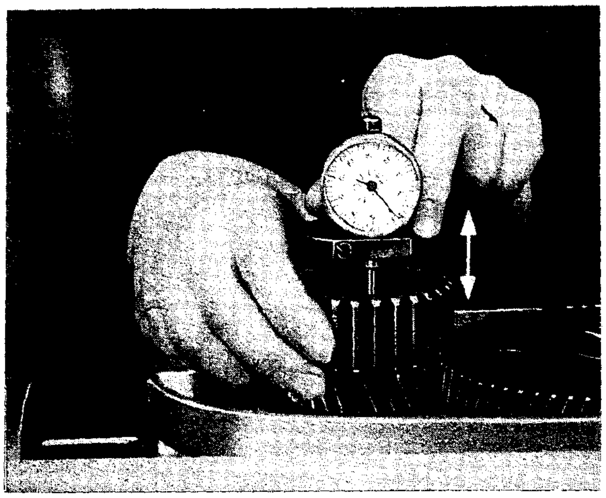


Fig. 76. Measuring the end play of the clutch driver

When the end play is greater than 0.10 mm, noise is emitted with unloaded engine which is caused by the helical teeth of the primary drive. The clutch driver is axially moved by changing loads. When the clutch is pulled while the vehicle is stationary and the engine running, this noise disappears (primary drive is stationary). The greater the end play of the clutch driver is set, the louder this noise will be. In the loaded condition of the engine, it is not present.

The end play is varied with the help of different spacing washers (1) (Fig. 75). When the end play is smaller than 0.05 mm, the spacing and thrust washers will be tarnished, and the clutch fails to interrupt the power flow from the crankshaft to the gearbox because the driver has got stuck. Under these conditions, the clutch may be torn from the cone of the crankshaft.

4.6. Mounting the Clutch

- Remove the oil from the two cones (clutch body and crankshaft) and check the surface appearance.
  When the full cone fails to bear, it can be ground in with the help of grinding paste.
  In this operation, protect the grooved ball bearing 16005 - clutch thrust bearing -, and carefully remove the remains of the grinding paste.

When, for checking, the clutch is put on the crankshaft end without spring lock washer (1) and clutch driver (2), the cone must fit already in such a way that the clutch cannot be removed by hand.

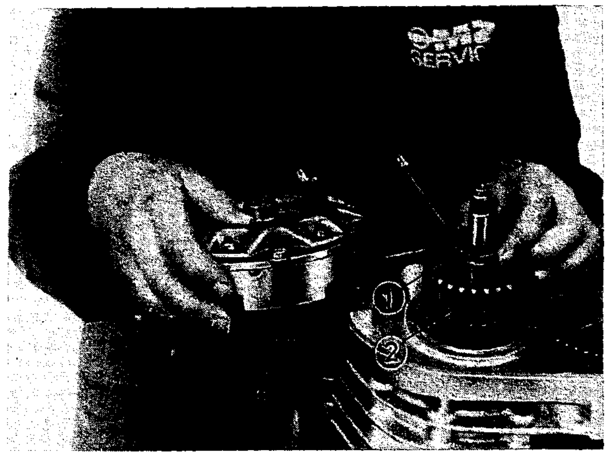


Fig. 77. Checking the cone of the clutch

- Mount the clutch. Due to its spring power, the spring lock washer under the clutch retains the thrush washer (4) in place (Fig. 75). The pre-tension of the spring lock washer is good when the clutch, which is being mounted (before tightening), slightly tilts in the cone.
- Before mounting the clutch cover, the clutch must be properly tightened with the help of a spacer tube (A).

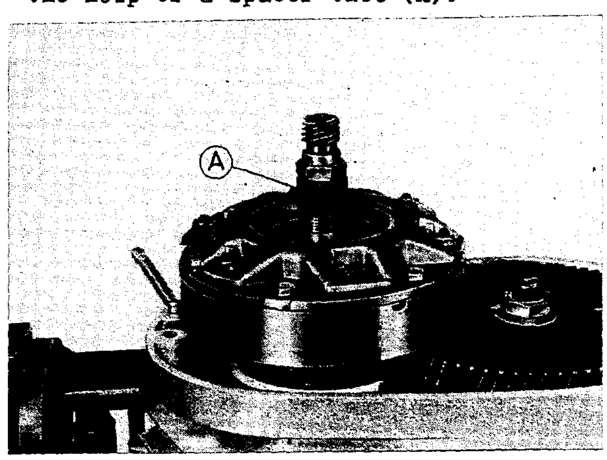


Fig. 78. Tightening the clutch

4.7. Completing and Mounting the Clutch Cover

4.7.1. Mounting the Kick-starter Assembly

The kick-starter sub-assembly is provided with a positive tracking for the dog of the kick-starter from the kick-starter wheel. In starting the engine, it restricts the transmission of a back-kick moment to the wheels and gears of the gearbox.

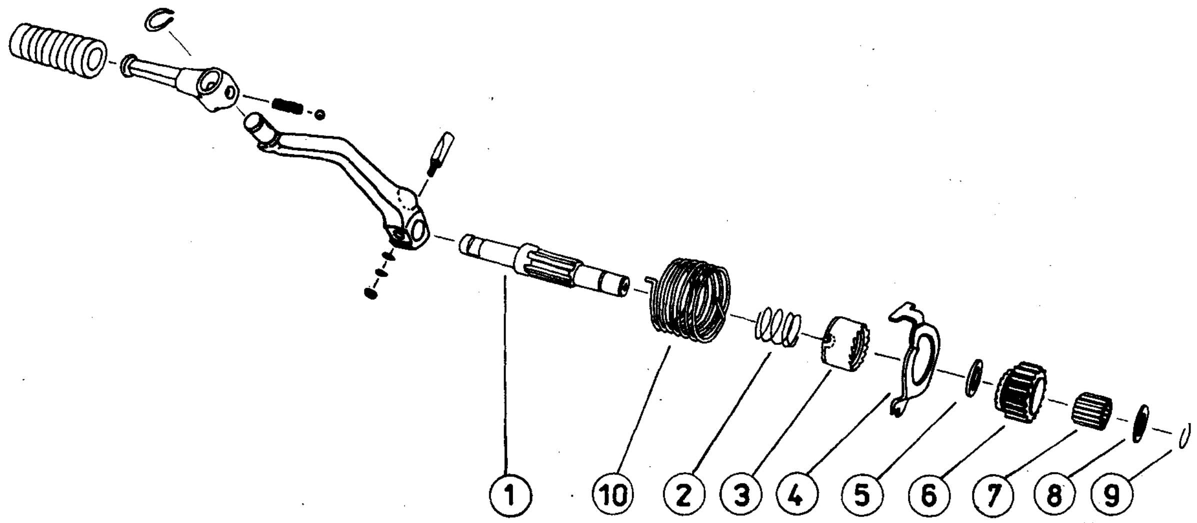


Fig. 79. Individual parts of the kick-starter sub-assembly

Mount the kick-starter shaft in the order of numbers demonstrated in Fig. 79.
Fit the dog (3) in the manner shown on the left of Fig. 80. The right part of Fig. 80 shows a kick-starter shaft mounted in the wrong manner.

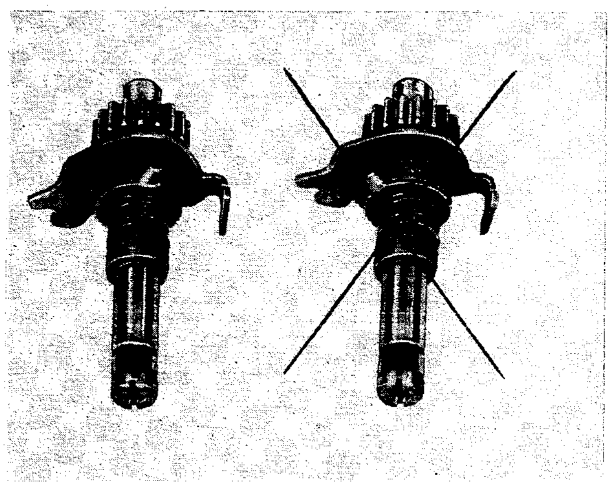


Fig. 80. Correct mounting of the dog (left)

Before fitting the 24 bearing needles (7) 2.5 x 19.8, the kick-starter wheel (6) is provided with grease and pushed on the kick-starter shaft (1) so that it contacts the thrust washer (5).

Finally, mount the kick-starter spring (10). The end of the spring must be pushed into hole (A) of the kick-starter shaft up to the stop. Fig 81 shows the kick-starter shaft ready for being mounted.

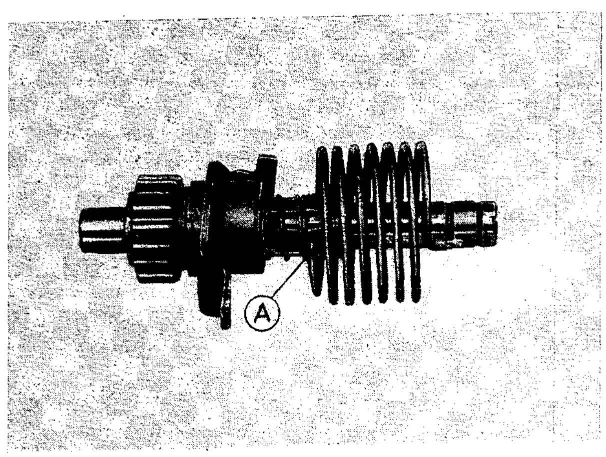


Fig. 81. Complete kick-starter shaft

The pre-assembled kick-starter shaft is now clamped at its bearing pin in a vice between copper jaws or wooden inserts, immediately below the kick-starter wheel, according to Fig. 83.

Insert the rubber rings for sealing the kick-starter shaft and foot-operated gear-shift shaft into the recesses provided in the clutch cover, slightly oil the parts and mount the clutch cover from above on the kick-starter shaft. At the same time, the spring end of the kick-starter spring is pressed into the hole (B) provided in the clutch cover.

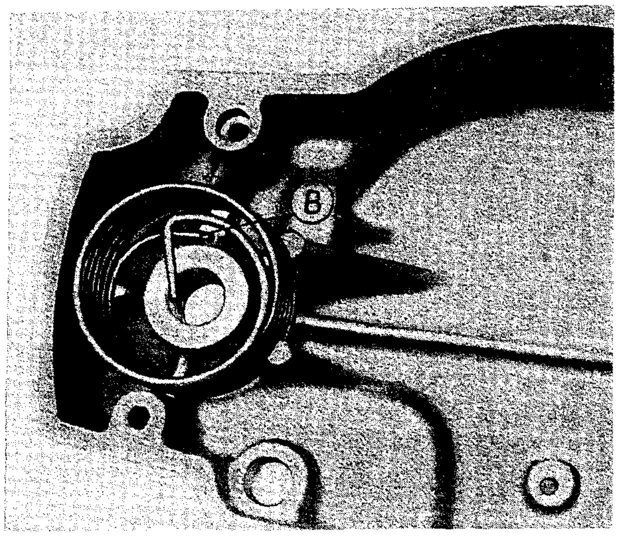


Fig. 82. Mounted position of the clutch spring

Turn the clutch cover through about 1 1/4 revolution anti-clockwise and put the splined bolt through the kick-starter lever meanwhile fitted and screw it together with the nut (Fig. 83).

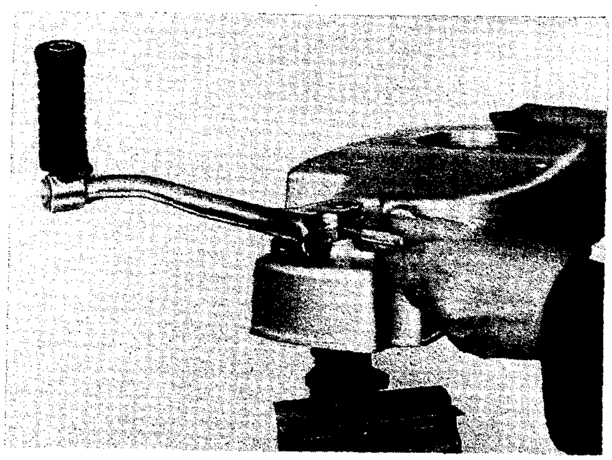


Fig. 83. Fastening the kick-starter lever

4.7.2. Mounting the Clutch Actuation Mechanism (see Figs. 21 and 87)

Push bearing bush (17) with supporting bearing 6302 of crankshaft (retained by circlip) from outside into the clutch cover, the markings (M) must point upwards, Fig. 85. Turn the pressure lever (16) from inside into the threaded worm of the bearing bush fully down and hook on the tie rod (19).

4.7.3. Mounting the Clutch Cover

After completing the clutch cover, the packing is placed on the cleaned sealing surface (without sealing compound) and the clutch cover mounted.
As shown in Fig. 84, the cam plate of the positive tracking is put with its nose (1) into the casing.

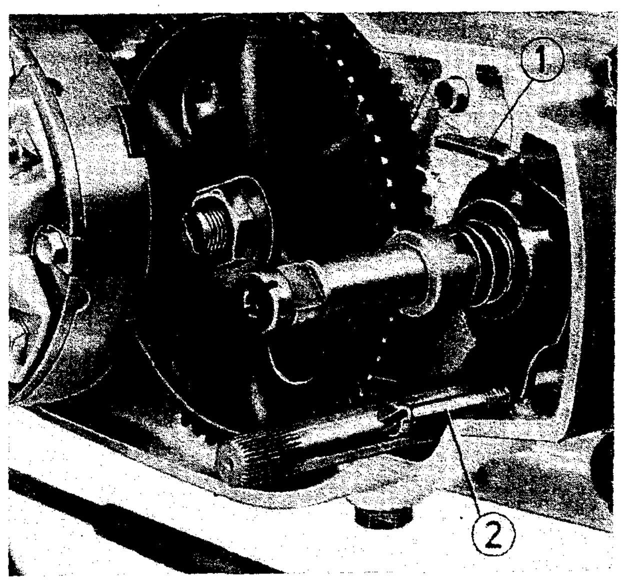


Fig. 84. Correct position of the cam plate

The casing screw (2) retains the cam plate at its lower end.
For the sake of clearness, the clutch cover is not shown in Fig. 84; this illustration does not show the mounted state.
By applying slight rebounding blows with a rubber mallet drive the clutch cover on to the sealing surface and, at the same time, turn the kick-starter shaft to the right so that the kick-starter wheel can engage with the gear of the 1st speed.
Using new packing rings, insert the 5 casing screws and tighten them uniformly and crosswise, thus, fastening the clutch cover.

4.7.4. Rough Adjustment of the Clutch

Before the clutch can be adjusted at the bearing bush of the clutch cover, the clutch must be tightened by means of the supporting bearing of the bearing bush in the clutch cover. Place the spring lock washer B 14 on the crankshaft end and tighten the drive gear for speedometer or, in the standard design, the nut M 14 x 1.5 (WoF 22) with a torque of 80 to 100 Nm (8 to 10 kpm).
Push the pipe (1) over the tie rod (Z), see Fig. 87. Pipe (1) and tie rod (Z) are connected through the bolt (2) 8 mm in diameter which is put through the hole for the cable control. Then turn the bearing bush (arrow a) (3) until the pipe (1) contacts the clutch cover. With this, the basic adjustment of the pressure member (D) with A = 11 mm is determined.

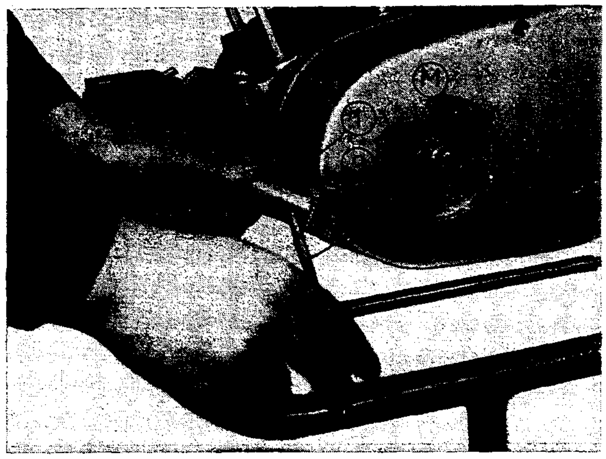


Fig. 85. Rough adjustment of the clutch

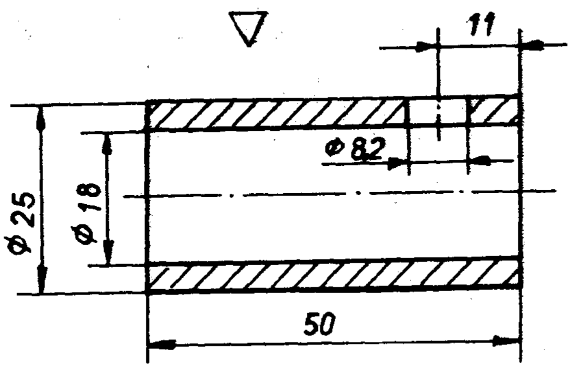


Fig. 86. Tube for the rough adjustment of the clutch

After the rough adjustment of the clutch, immediately plug the adjusting plate in place (18), see Fig. 21, and mount the housing for the speedometer drive with packing ring. Then, and only then, the rough adjustment is fixed.

NOTICE: For fastening the housing for the speedometer drive, only use screws M 6 x 25. Longer screws will impair the function of the clutch actuation mechanism.

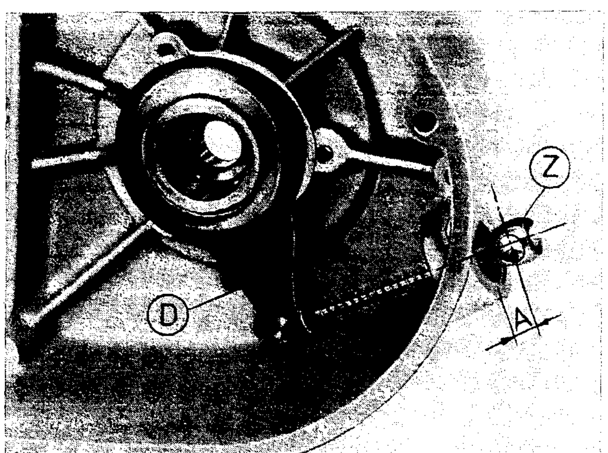


Fig. 87. Explanation of clutch rough adjustment

4.7.5. Clutch Fine Adjustment

Fine adjustment of the clutch is effected with the help of the adjusting screw of the clutch lever at the handle-bars.
The free play at the clutch lever should be anything between 2 and 3 mm.

When slipping of the clutch occurs, as a rule, first check the rough adjustment before the clutch is replaced.

4.8. Drive for Speedometer

The drive of the speedometer of the deluxe model is mechanically effected directly from the crankshaft to the clutch side.

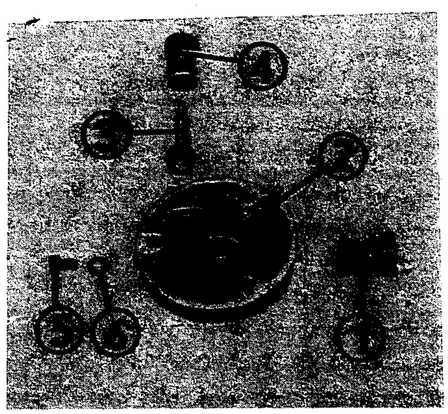


Fig. 88. Speedometer drive

In the place of the M 14 x 1.5 fastening nut for fastening the clutch, the drive gear for the speedometer drive (1), which is centred on an additional collar of the crankshaft, is used.
In the housing for the speedometer drive (2), the complete drive shaft is supported (3) in a plastic stopper (4) which is retained by a fillister-head screw (5) with corrugated washer (6).

The speedometer drive requires no maintenance; when being mounted it is fitted with molybdenum disulphide grease.

4.9. Oil Supply for the Lubrication of the Crankshaft Main Bearings and Shaft Seal Rings (see Fig. 60)

The two 6306 crankshaft main bearings are lubricated by the fuel-oil mixture also passing through the crankcase. The petroil lubrication offers the advantage that the bearings continuously receive new and clean lubricating oil. In the crankcase, an oil catch pocket (4) is arranged which covers the two casing halves. In order that the two bearings are uniformly supplied with oil, the oil catch pocket (4) is separated in its centre (casing joint) by means of an oil separating plate (5) of rubber which is fitted in assembling before mounting the right-hand casing half.

The lubricating oil collected in the oil catch pocket (4) passes through an oil hole (6) into the compartment between oil guide plate (7) and shaft seal ring. During engine operation, this free space is continuously filled up to the lower edge of the hole in the oil guide plate and in this way supplies the sliding point of shaft seal ring and crankshaft end.

After having supplied the shaft seal ring, the oil lubricates and cools the crankshaft main bearing.

4.10. Lubrication of the Gearbox

By the drive gear (68 teeth), a part of the oil from the clutch compartment is pumped up into the oil catch pockets of the left-hand casing half (O, Fig. 59). From this catch pockets, the oil flows on to the oil guide plate (L, Fig. 57) and through the holes in the oil guide plate directly on the teeth of the gearbox gears and from the rear catch pocket over the circlip which is open at the top into the oil catch plate of the drive shaft (arrow A, Fig. 59). Through the hole drilled in the drive shaft, the oil passes to the bearing of the loose wheels for the 2nd and 3rd speeds and lubricates them.

4.11. Assembling Faults

When the engine is assembled with the casing halves in a cold state, the bearing seats in the casing will be destroyed. Then the bearing external rings will rotate in the casing. The undue force applied in mounting the gearbox shafts and the crankshaft into cold bearing inner rings, that is to say, rings which are too cold for mounting and thus too narrow, leads to deformations in the bearings and, maybe, to an impermissible large radial eccentricity of these shafts.

From these defects result, for example, gear-shift errors of the gearbox, incorrect running of the engine because of hardly correct adjusted advanced ignition, premature wear of components and parts.

4.12. Mounting the Engine in the Cycle Parts

For mounting the engine in the cycle parts, proceed in the inverse order of the operations described in the Sections 3.1.1. to 3.1.4. Every repair of the engine entails the adjustment of the timing of ignition and of the carburetter. Further details of these adjustments are given in the Sections 6.5.3. and 7.1.4.

5. Cycle Parts

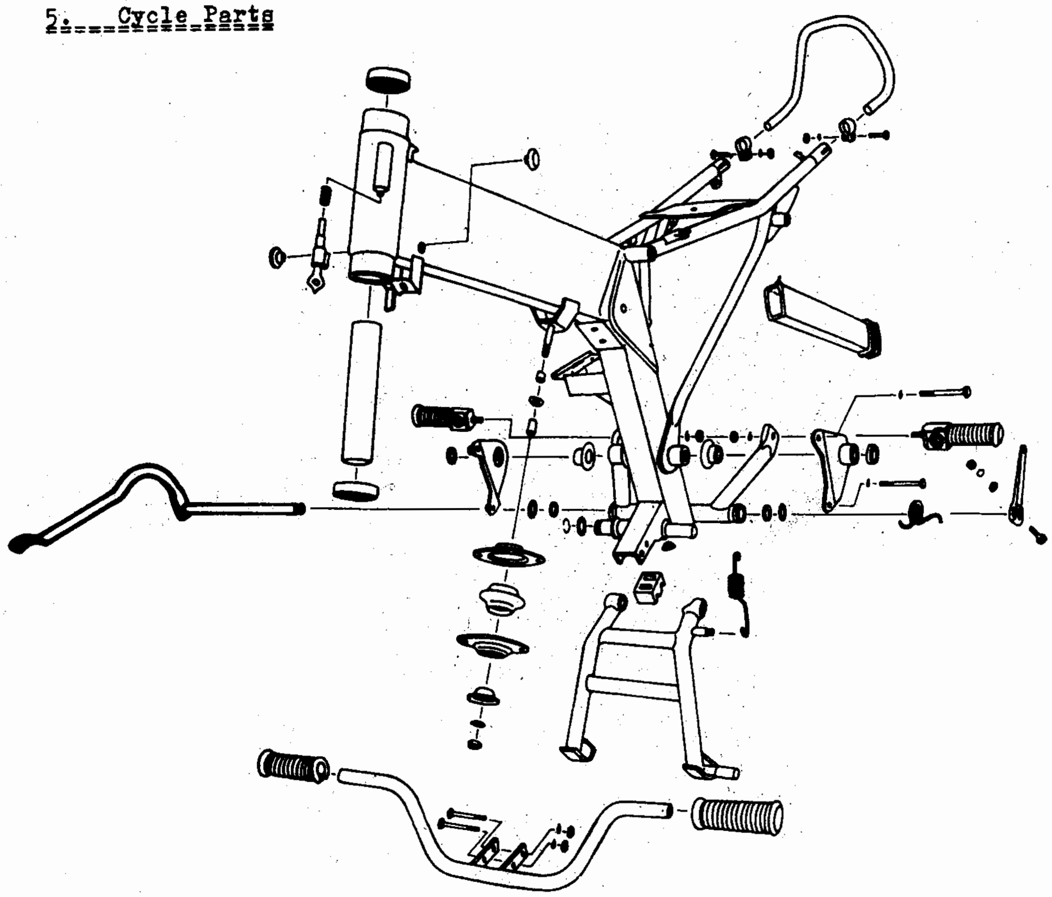


Fig. 89. Exploded view of cycle parts

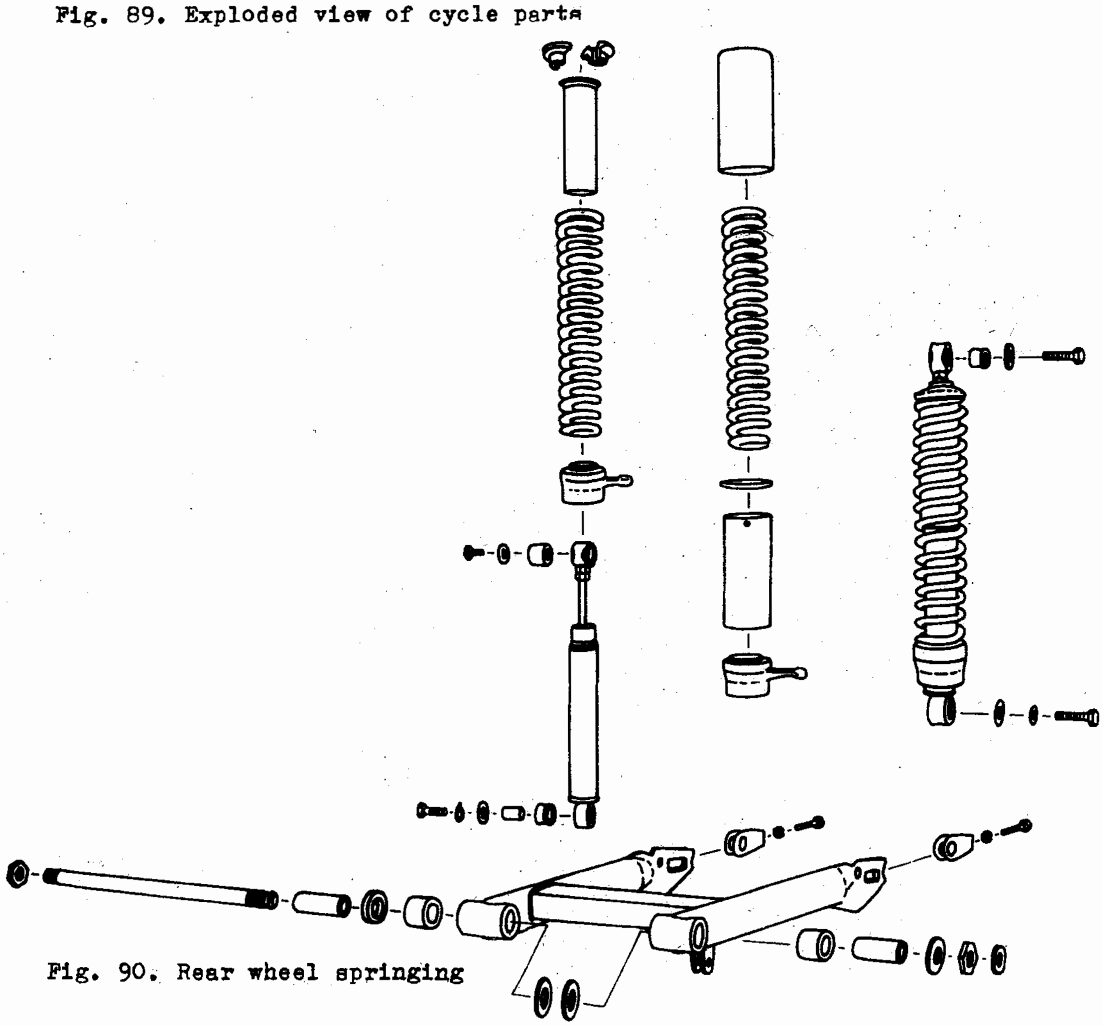


Fig. 90. Rear wheel springing

6'

The general design, which has already been indicated in Figs. 1 and 2, is shown in full detail in the exploded view of the cycle parts in Fig. 89. Below further instructions for repairs and explanations of details of various sub-assemblies are given.

5.1. Rear-wheel Springing and Rear Elastic Engine Mounting

Fig. 90 shows the design of the rea-wheel springing. The rear-wheel springing includes the rear-wheel swing-fork whose mounting is combined with the engine suspension and the spring-loaded suspension units.

5.1.1. Mounting of the Rear-wheel Swing-fork

The carrying part of the mounting is the swing bearing bolt (11) which is clamped in the frame by the frame bearing tube (10), the right-hand and left-hand inner tubes (1) and (2) and the three thrust washers (16). Tightening torque for the hexagon nut (17) is 70 to 80 Nm (7 to 8 kpm). Tighten the swing bearing bolt only when the swing-fork is fully supported by springs.

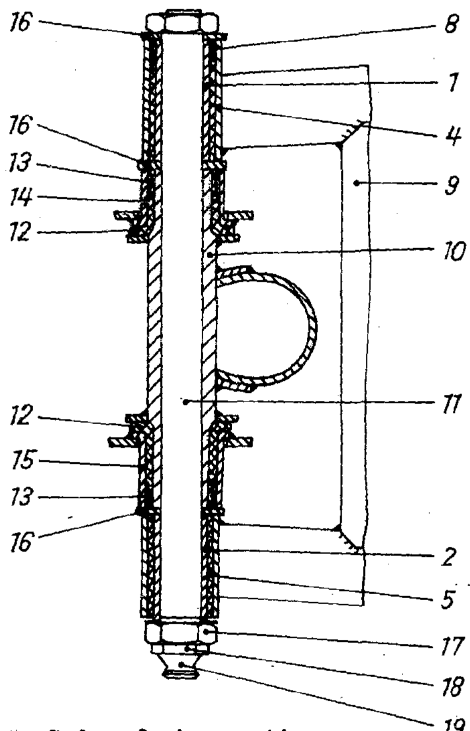


Fig. 91. Swing-fork mounting

(1) Right-hand inner tube, 54 mm lon(
(2) Left-hand inner tube, 44 mm long
(4) and (5) Rubber bush, 25 mm long
(8) Spacing sleeve, 10 mm long (polyamide)
(9) Rear-wheel swing-fork
(10) Frame bearing tube
(11) Swing bearing bolt
(12) Bearing rubber
(13) Spacer ring (polyamide)
(14) Engine shoe, right-hand
(15) Engine shoe, left-hand
(16) Thrust washer
(17) Hexagon nut M 18 x 1.5
(18) Adjusting ring
(19) Groove for hanging on the prop stand spring

After assembling, the swing-fork mounting is completely free from maintenance.

The rear-wheel swing-fork is delivered by our Spare Sales Department complete with the rubber elements pressed in place. For the use of the side-car, changed swing-forks and bearing bolts are available.

5.1.2. Replacement of the Rubber Bearing - Rear-wheel Swing-fork

- Pressing out the inner tubes (1) and (2) with the help of a mandrel on a mandrel press;
- Removing the supporting ring (8);

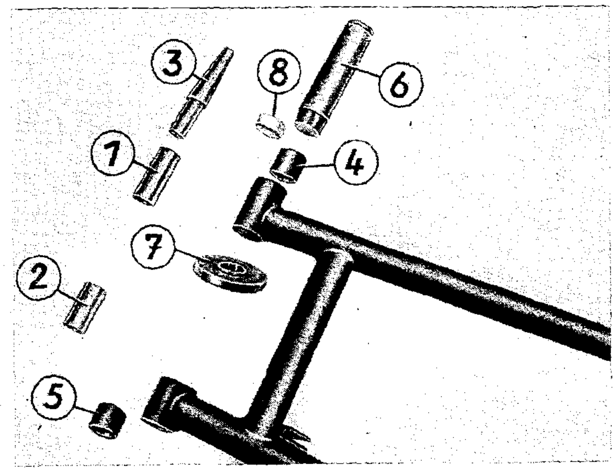


Fig. 92. Fitting the rubber bearings

- Cutting up and pressing out the rubber bushes (4) and (5);
- Pressing in the new rubber bushes (4) (in a dry state) with a mandrel from the outsides of the swing-fork, insert the intermediate ring (7). For the left-hand swing boss use the short and for the right-hand swing boss use the longer cylindrical lug of the mandrel (6).
- Insert from outside the supporting ring (8) - 10 mm wide - into the right-hand swing boss;
- Put the inner tube (1), 54 mm long, and then (2), 44 mm long, on the cylindrical end of the mandrel (3) and, with the taper end ahead, press the mandrel into the rubber bushes wetted with soap water until the inner tube projects uniformly from the two sides of the swing tube.

5.1.3. Demounting and Mounting the Swing Bearing Bolt

Remove the adjusting ring (18) and left-hand hexagon nut (17), drive out the swing bearing bolt to the right by means of an auxiliary mandrel and leave the auxiliary mandrel plugged in place for centring the swing-fork (see Figs. 91 and 93).

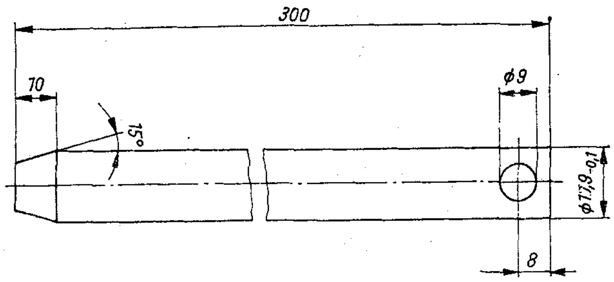


Fig. 93. Sketch of auxiliary mandrel

When fitting, the swing bearing bolt must be provided with grease to protect it from corrosion. Screw the hexagon nut on the right-hand end of the swing bearing bolt up to the end of thread.
Push through the swing bearing bolt from the right to the left, the auxiliary mandrel is still plugged in the swing. Tighten the left-hand hexagon nut with 70 to 80 Nm (7 to 8 kpm) (the swing-fork is fully spring-supported) and provide the adjusting ring with a check nut.

5.1.4. Mounting the Rear Swing-fork Including Engine Suspension

- Push the bearing rubbers, spacer rings and engine shoes on the left and right ends of the frame bearing tube;
- Compress the engine shoes axially to the length of the frame bearing tube with the help of the pressure rings (see Fig. 94);

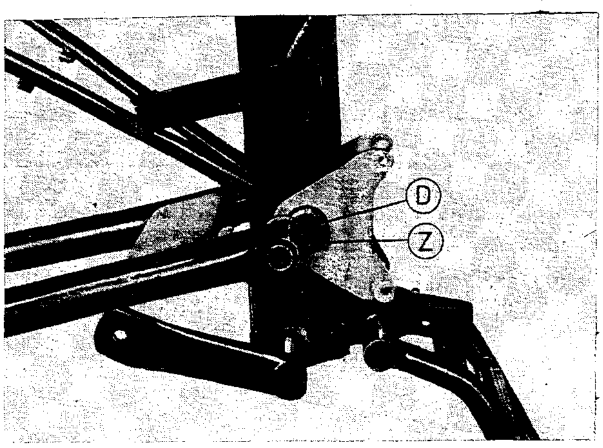


Fig. 94. Engine shoes axially compressed by pressure ring (D) and tie rod (Z) with thread M6, rear-wheel swing-fork pushed in place

- Push the rear-wheel swing fork with thrust washers from the rear on the engine shoes up to the stop at the pressure rings. Remove the pressure rings and further push the swing-fork up to the centre of the hole for the bearing bolt;
- Press in the auxiliary mandrel from the left and centre the bearing with it;
- Screw the right fastening nut up to the end of thread on the swing bearing bolt.
- Grease the swing bearing bolt and press it in from the right to the left.

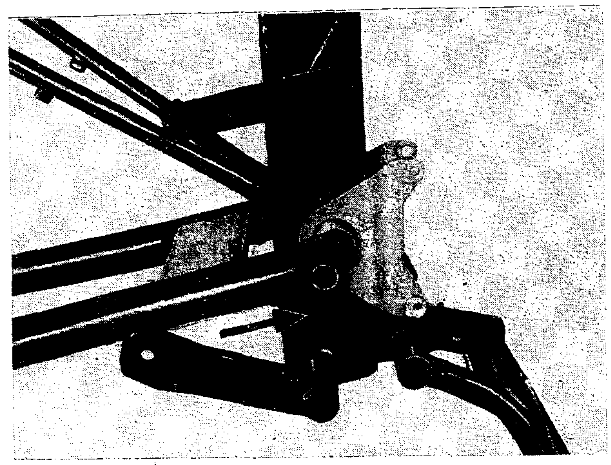


Fig. 95. Put on the rear-wheel swing-fork in the direction of the arrowhead; pressure rings already removed

- Tighten the left-hand hexagon nut with 70 to 80 Nm (7 to 8 kpm) (the swing-fork is fully spring-supported) and provide the adjusting ring with a check nut.

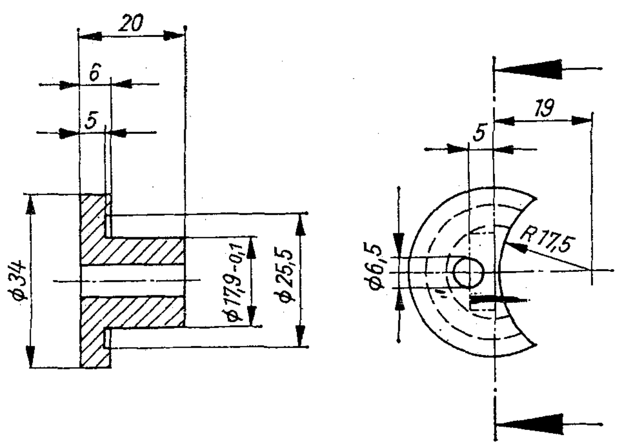


Fig. 96. Sketch of pressure ring

5.1.5. Rear Engine Suspension (Fig. 91)

The bearing rubbers (12) and spacer rings (13) of the rear engine suspension can only be replaced with the engine and the rear-wheel swing-fork removed according to the previous Section.
The wear limit has been reached when the engine shoes in mounted condition no longer show any pre-tension and can be moved by hand laterally to and fro.

When replacing the bearing rubbers (12) and spacer rings (13) by new ones check that the bearing sleeves of the engine shoes are free from wear or not. When in the drill hole, at the point where the spacer ring is applied, a shoulder can be felt, then the replacement of the engine shoes is advisable in the interest of an adequate service life of the new rubber parts and spacer rings.

5.1.6. Repair of the Suspension Units

Repairs are limited to the replacement of defective parts of the spring-loaded suspension units and the lubrication of the adjusting sleeves of the rear suspension units.
The shock absorbers must be replaced completely and brought to a shop for regeneration. Self-repair of shock absorbers is not possible. In case of loss of oil, the lacking amount can be replenished (special wrench 05-MW 82-4), in most cases, however, the packing of the piston rod will be defective - the shock-absorber must be regenerated.

Shock-absorber marking

The marking is arranged above the lower fastening eye.

Example: A 22 - 100 - 88/8 M 1.50/1

Meaning:

A 22	model
100	rated stroke in mm
88	damping force in the direction of pull in kp
8	damping force in the direction of compression in kp
M	with adjustment
1.50/1	number of manufacturer

From June 1978, the letters OV or MV are omitted. "With adjustment" is indicated by "M".

Demounting the shock absorbers

Clamp the lower eye of the suspension unit in a vice. Press down the protective sleeve (8) and take out the two supporting-ring halves (1). Now, the parts (8), (9) and (11) can be removed.

Possible shock-absorber defects

1. The shock absorber is ineffective although no oil loss is visible (foreign particles between the diaphragms of the piston valve).
2. Damping commences not soft but jerkily - the suspension units are "stamping" (insufficient amount of damping liquid present or bottom valve leaky).
3. Damping liquid leaks out.

Topping up shock-absorber oil

Unscrew the threaded piece (4 in Fig. 97) by means of a special wrench 05-MW 82-4 and pull out the damping device. Clean all parts in pure benzine and fill in new oil. Tighten the threaded piece with about 49 Nm (5 kpm).

Mating shock absorbers

To ensure a good roadability, the shock absorbers of one axle must show the same damping values.
The marking of the tolerance group is on the upper face of the piston rod (7 in Fig. 97).
A green colour dot means a negative deviation from the rated value of the damping force. If there is no colour marking, then the deviation is positive. Shock absorbers with the same marking should always be mated, i.e. arranged in pairs.

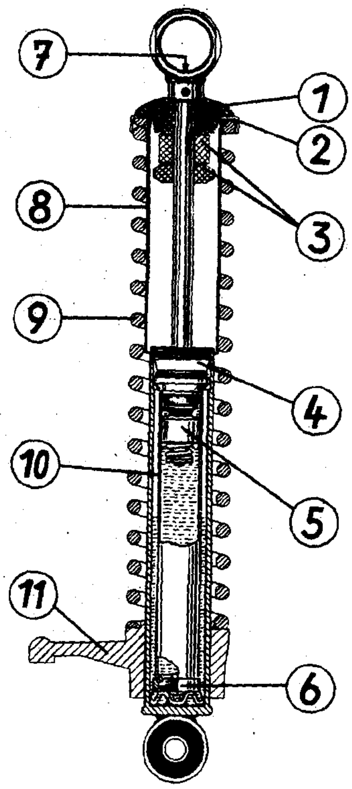


Fig. 97. Design of the shock absorber

(1) Supporting ring halves
(2) not applicable
(3) Stop rubbers
(4) Threaded piece with radial seal ring AC 10 x 19 x 7
(5) Piston with non-return valve (top) and damping valve (bottom)
(6) Bottom valve with supporting ring
(7) Marking of tolerance group
(8) Protective sleeve
(9) Compression spring
(10) Piston tube
(11) Adjusting sleeve

Springs for suspension units

Description	Unit	Solo	with Side-car
Length (relaxed)	mm	260^{+8}	260^{+8}
External diameter of spring	mm	$55_{-0.8}$	$52^{+0.8}$
Wire diameter	mm	7	7
Turns	number	16.5	17.5
Spring constant	N/mm	15.23	17.304

The spare spring for the solo model is not marked.

The spare spring for the side-car model has a white colour marking on the central turn.

5.2. Engine Suspension at Cylinder Head

The design of the front elastic engine suspension is shown in Fig. 98. For the repair or the replacement of the front engine suspension, it is practical to demount the carburetter and induction socket and to remove the ignition cable.

The exhaust system can be left on the engine, only the connecting screw between rear exhaust clip and exhaust brace must be loosened.

After unscrewing the two M 8 nuts from the cylinder head, lower the engine to the position shown in Fig. 98. Then loosen the M 10 nut serving for fastening the front suspension to the frame and all individual parts can be removed.

When assembling, see to it that all screwed connections are properly tightened!

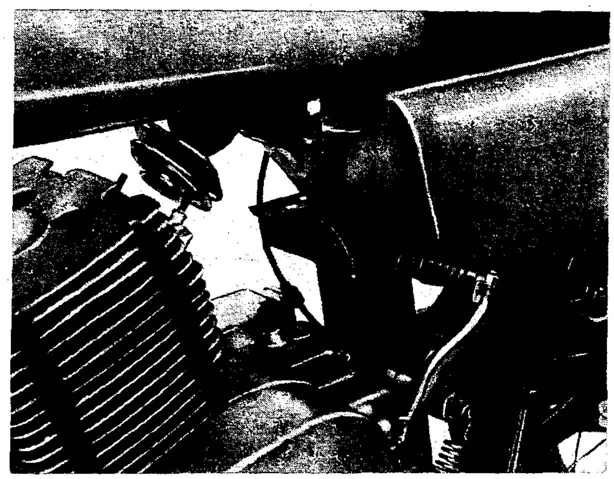


Fig. 98. Replacement of the elastic engine suspension at the cylinder head

5.3. Telescopic Fork

Figs. 99 and 100 show the design and the arrangement of the individual parts of the telescopic fork. The repair of individual sub-assemblies is described in detail below.

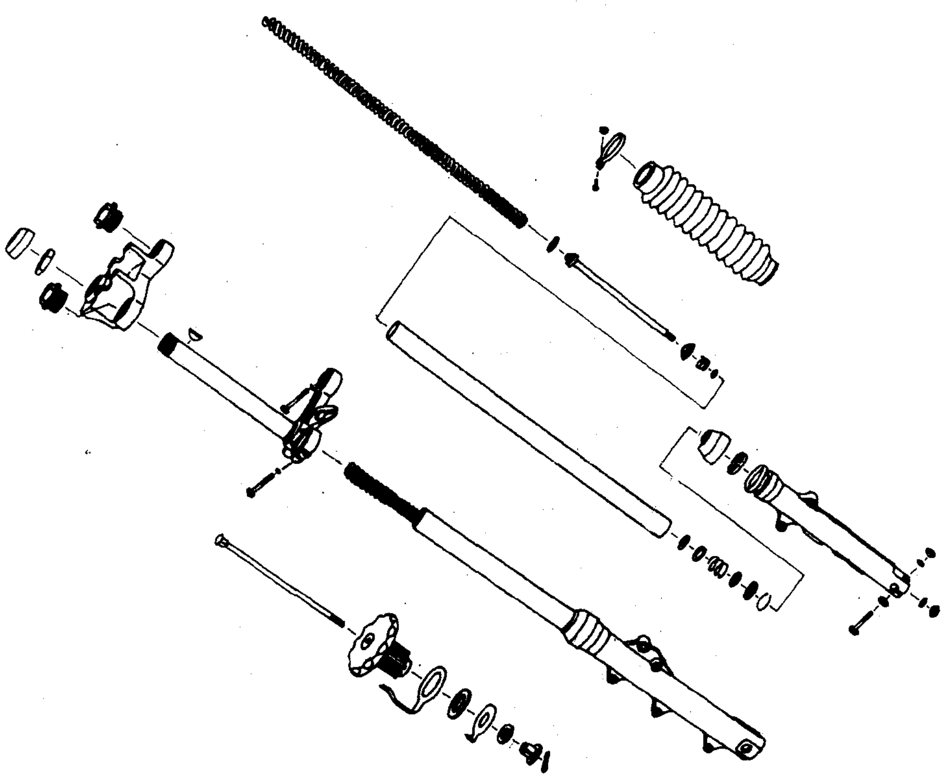


Fig. 99. Exploded view of the telescopic fork

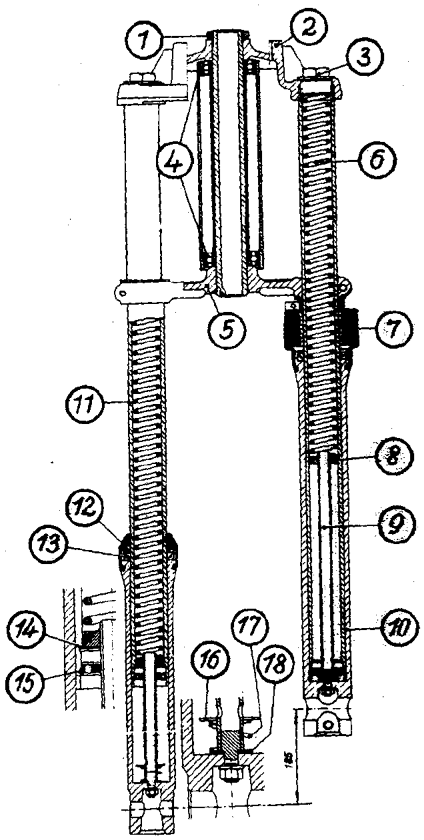


Fig. 100. Telescopic fork and steering bearing (sectional view)

Right-hand fork member:

Spring fully extended, design with protective cap

(1) Nut for control tube
(2) Upper clamping head
(3) Screw plug
(4) Steering bearing 6006
(5) Lower clamping head
(6) Compression spring (solo spring wire 4.0 mm in diameter
side-car spring wire 4.5 mm in diameter)
(7) Protective bellows
(8) Piston ring at supporting tube
(9) Supporting tube
(10) Sliding tube
(11) Guide tube
(12) Protective cap
(13) Radial seal ring 35 x 47 x 7
(14) Thrust washer, thickness 2.0 mm and locking ring
(15) Valve plate, throttle and circlip
(16) Plate for final stop
(17) Compression spring for final stop
(18) Sealing washer

5.3.1. Steering Bearing

Two radial grooved ball bearings 6006 are employed for the steering assembly; a spacer sleeve is inserted between these bearings which are completely free from maintenance.

No adjustments have to be made during assembling and later on.

THE STEERING ASSEMBLY IS MOUNTED IN THE FOLLOWING WAY:

- Fill the 6006 ball bearings with anti-friction bearing grease;
- Press the lower bearing up to the stop on the external ring, use an intermediate ring Ø 54 x 20 for this purpose;
- Insert the spacer sleeve;
- Press the upper bearing on the spacer sleeve until the inner ring contacts the latter.
  Observe the following:
  Place a spacer ring Ø 54 x 40 mm under the lower bearing in order that it will not be pressed out and press the upper bearing over the spacer ring Ø 54 x 20 in place.

  NOTICE: In the later mounting of the upper and lower clamping heads, take care that the nut for the control tube (1), Fig. 100, is tightened with a torque of 150 Nm (15 kpm)!

Then, the steering assembly must be free to be moved easily and it must not jam in any position. If this, however, should be the case, the spacer sleeve between the inner track rings of the bearings must be replaced (the short spacer sleeve may lead to a deformation of the bearings).

The removal of the steering bearings from the frame is effected according to the Figs. 101 to 103 with the help of the extractor 22-51.006.

The removal and mounting of the telescopic fork required for this purpose is explained in Section 5.3.2.

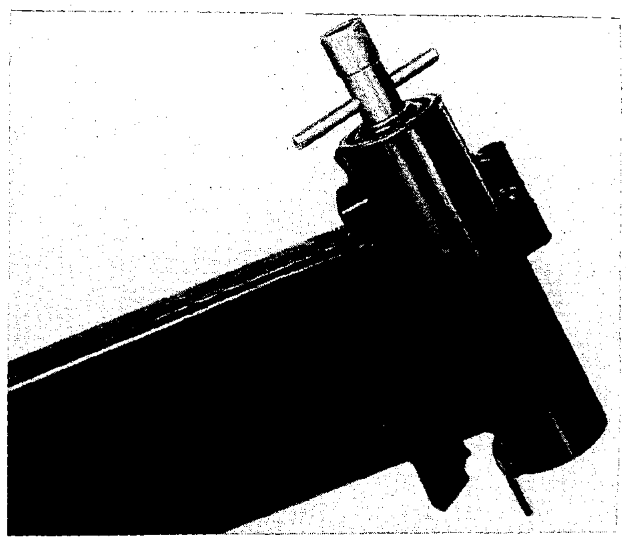


Fig. 101. Press the internal part of the extractor into the ball bearing

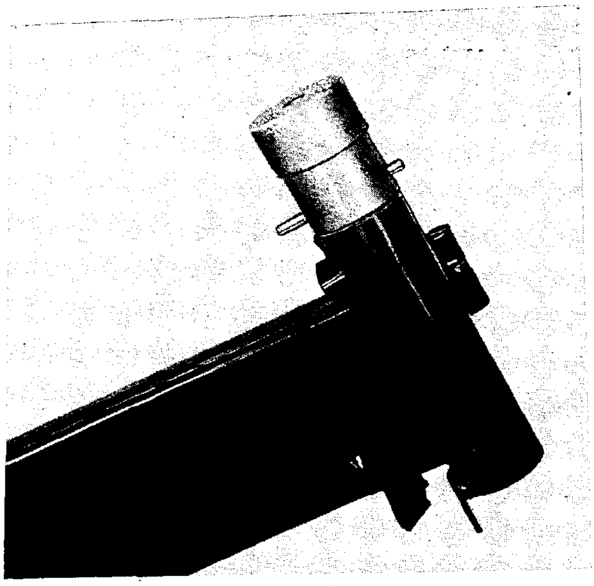


Fig. 102. Fitting the upper part of the extractor

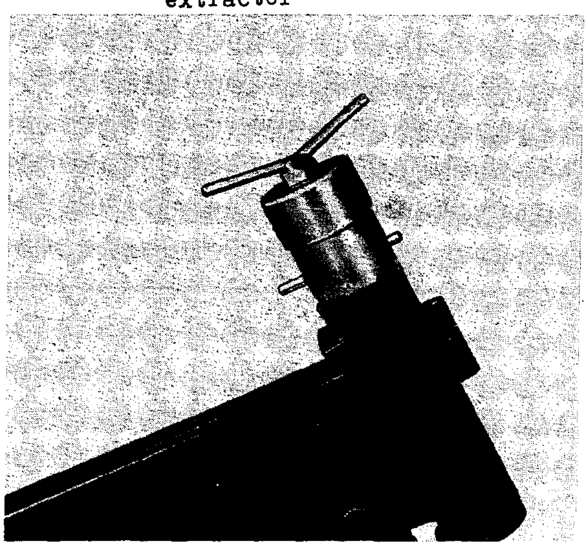


Fig. 103. Fitting the screw, tightening it and thus extracting the bearing from the frame

5.3.2. Criteria for Dismantling the Telescopic Fork

Dismantling the telescopic fork members becomes necessary:

1. When, due to an accident, the guide tubes are distorted. The telescopic fork jams when it is contracted.

   NOTICE:

   The telescopic form jams when being contracted even if the fork members are not parallel!

   CAUSE:

   The clamping screw of the knockout wheel spindle has been clamped before the wheel spindle has been tightened. As a consequence, the two fork members have been distorted.

2. When the permissible wear limit between guide tube and sliding tube has been reached.

   TEST METHOD:
   The vehicle is on the prop stand, the telescopic fork is fully extracted. The two sliding tubes are moved to and fro at the axle accomodation. The maximum play must not exceed 2.2 mm (new state 0.8 to 1.2 mm). For this measurement, the two fork members must not be distorted because otherwise the play may be reduced.
   In case of doubt, the complete fork members must be removed, the guide tubes clamped "in soft protective jaws", and the existing play at the axle accomodations measured by means of a dial gauge.

3. When the fork members lose oil (radial seal rings in the sliding tube are leaky). Oil level checking: see Fig. 114.

4. When the hydraulic oil damping is insufficient with the full amount of oil present.

5. When the protective caps or protective bellows must be replaced by new ones.

5.3.3. Demounting and Mounting the Complete Telescopic Fork (see Fig. 100)

It is possible to demount the complete telescopic fork without loosening cable connections. The following order is advisable:

- Unhook the hand brake cable control from the handle-bars and loosen the brake hose from the brake saddle. Draw the hose out of the lower clamping head, close its opening with a suitable stopper and fasten it to the handle-bars.
- Demount the cap for the control tube fastening nut and steering damper.
- Slacken back nut for control tube and screw plugs of guide tubes by means of socket wrench or flat box spanner.
- Demount the headlamps (completely).
- Remove the instrument pod, place the handle-bars on the fuel tank.
- Demount front wheel, brake saddle, and front-wheel mudguard.
- Completely demount the flashing-light direction indicators, front, with their holders.
- Unscrew the nuts for control tube and the screw plugs.
- Carefully drive out the upper clamping head upwards and the lower clamping head with fork members downward.

NOTICE:
The hanging-down instrument pod, flashing-light direction indicators, headlamp and the handle-bars must be so protected that they will not be damaged and the cables not pulled out!
The complete telescopic fork is mounted in the inverse order. Pay particular attention to the correct installation of the cable harnesses. After connecting the brake hose, the disk brake must be bled.
AFTER ASSEMBLING, THE SCREWED CONNECTIONS ARE TIGHTENED IN THE FOLLOWING ORDER (Fig. 104):
- Nut for control tube (1), torque 150_{-30} Nm (15_{-3} kpm);
- Screw plugs (2) torque 150_{-30} Nm (15_{-3} kpm);

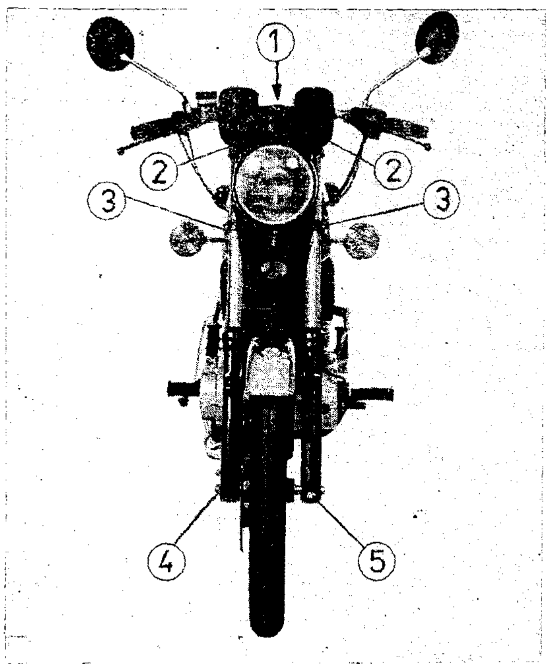


Fig. 104. Order for tightening the screws

NOTICE:

Apply decorators' size "Chemisol 1405" to the external thread of the screw plugs (Manufacturer: VEB Schuh-Chemie, Erfurt) and fit them (remove the old sealing compound).
In countries other than the GDR use rubber solution.
Do not allow sealing compound to get into the guide tubes, remove sealing compound from the faces of the screw plugs.

- Clamping screws (3) at lower clamping head 20 Nm (2 kpm);
- Nut for kockout wheel spindle (4) 80 Nm (8 kpm);
- Clamping screw for kockout wheel spindle (5) with the telescopic fork contracted 20 Nm (2 kpm).

5.3.4. Demounting and Mounting the Telescopic Fork Members

For demounting the individual fork members, handle-bars, headlamp and instrument pod need not be demounted. The brake system of the disk brake can be closed. For removing the right-hand fork member, however, the brake saddle must be demounted from the sliding tube and fastened to a suitable part at the vehicle until assembly. Fig. 105 has been included without the parts mentioned to provide a clear survey.

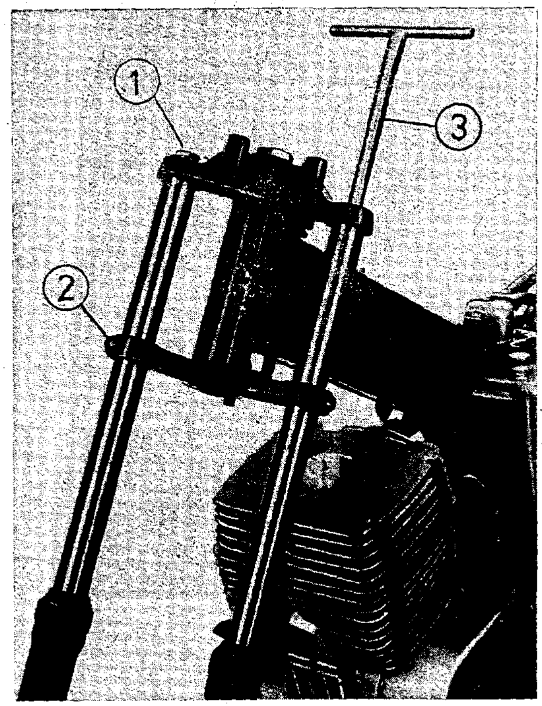


Fig. 105. Demounting and mounting the telescopic fork members

- Remove the screw plugs (1);
- Remove the front wheel;
- Demount the front-wheel mudguard ;
- Mark the guide tubes directly below the lower clamping head;
- Loosen the clamping screws (2);
- Draw the complete guide tubes with sliding tubes out downwards; use the fitting wrench 19 MW 22-1 (3).

Perform the mounting operations in the inverse order.
Tighten the screws in the manner described in Section 5.3.3.

5.3.5. Dismantling the Telescopic Fork Members Removed from the Vehicle

After having removed the protective caps or protective bellows, clean the fork members externally, draw out the compression springs (accomodated in the guide tube) upwards and decant the damping liquid.

DISMANTLING IS NOW EFFECTED IN THE FOLLOWING ORDER:

- Using an L-handled socket wrench (WoF 10), loosen the fastening nut (1) for the supporting tube and remove the nut and the corrugated washer (2) (Fig. 107);

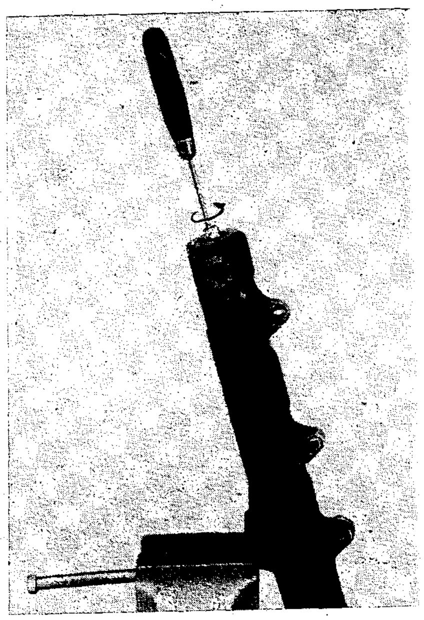


Fig. 106. Removing the fastening nut for the supporting tube

- If, during the loosening or tightening of the fastening nut of the supporting tube, the latter also turns, retain it by means of a screwdriver put through the socket wrench.
- Draw the guide tube (A) out of the sliding tube (B).

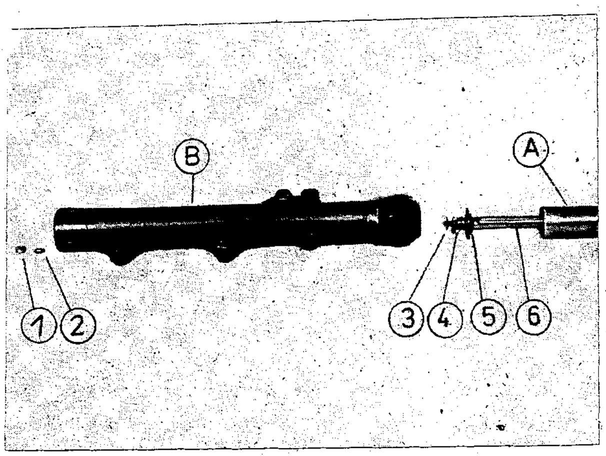


Fig. 1o7. Guide tube withrawn from the sliding tube

NOTE !

To be observed strictly - when clamping the guide tubes (A) in a vice, use soft protective jaws and clamp in the upper third only.
The sliding tubes have to be clamped at the axle accomodation or the fastening hubs for the mudguard or the brake saddle.

- Remove the sealing washer (3), the compression spring (4) 19 mm in diameter, and the cup for the final stop (5) from the supporting tube (6);
- Push the supporting tube (6) into the guide tube (A);
- Remove the annular ring 32 x 1.6 (Fig. 108) from the guide tube. The throttle arranged behind the annular ring (3) has a milled-out recess in its external diameter in order that the annular ring can easily be pressed out by means of a small screwdriver. Remove the throttle (3), the valve plate (4) and the compression spring for the valve plate (5) (see Fig. 109);

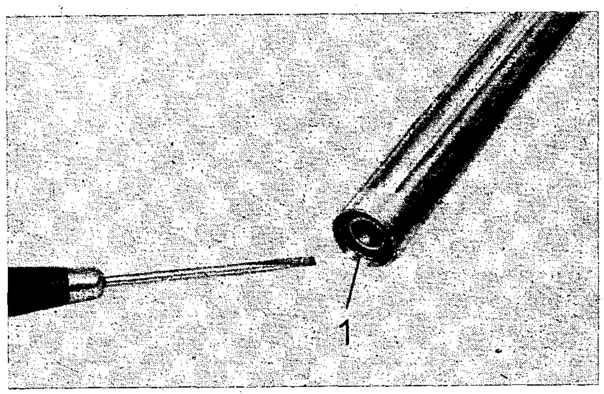


Fig. 108. Pressing the annular ring out of the guide tube

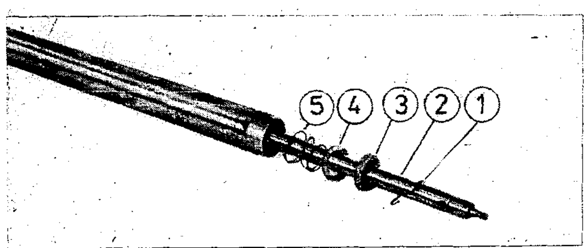


Fig. 1o9. Removing the throttle, valve plate and spring

- For the sake of clearness Fig. 109 has been included showing the assembly without the supporting tube pushed in.
- Remove the lock ring (1) seated behind the valve spring and the washer (2) from under the ring (Fig. 110).

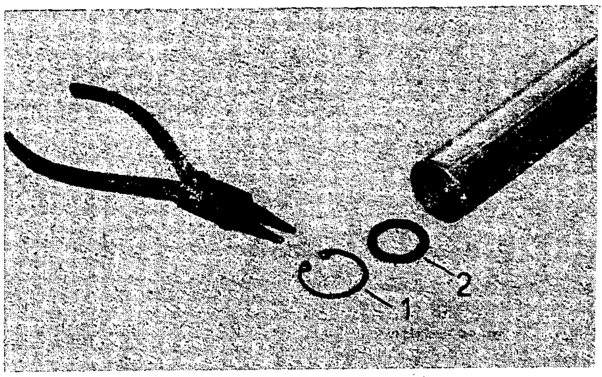


Fig. 110. Removing the thrust washer (2 mm in thickness)

- Using a piece of round wood (broom-stick, about 600mm long), push out the supporting tube. Do not push it over the interior thread of the guide tube because this will lead to damage to the piston ring on the supporting tube.

5.3.6. Mounting the Telescopic Fork Members Removed from the Vehicle and Checking for Wear

A basic condition for the serviceability of the telescopic fork after assembly is a clean working place. Dirt and dust deposits on the parts to be mounted lead to premature wear and failure of the telescopic fork.

The assembling operations are to be performed in the following order:

In a telescopic fork tight before demounting, the shaft seal ring must be checked for wear on the sealing lip and correct seat of the supporting spring (tensile spring under the sealing lip). In case of doubt it is advisable to replace the shaft seal ring by a new one.

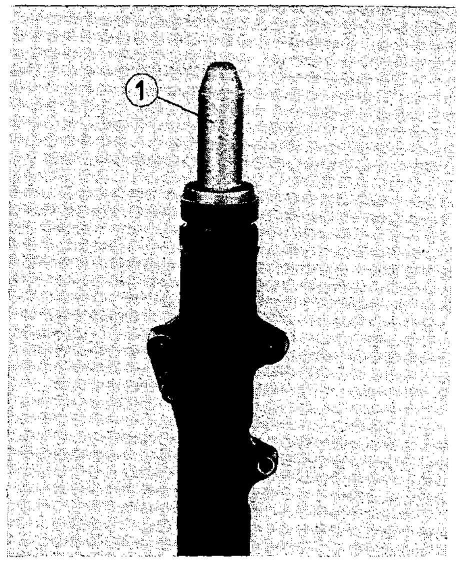


Fig. 111. Pressing the shaft seal ring in place

ASSEMBLING INSTRUCTIONS:

Only use the drift (1) 11 MW 7-4 for pressing the shaft seal ring in place.

DO NOT STRIKE THE RING. If this is done, the spring of the seal ring may be thrown off. In mounting, the sealing lip points to the damping oil, the closed side of the shaft seal ring to the top.

- Check the guide tube (A), Fig. 109, for chromium defects, scores and distortions In case of doubt, check for true running. Permissible eccentricity 0.05 mm.

Re-bending and straightening are not permitted!

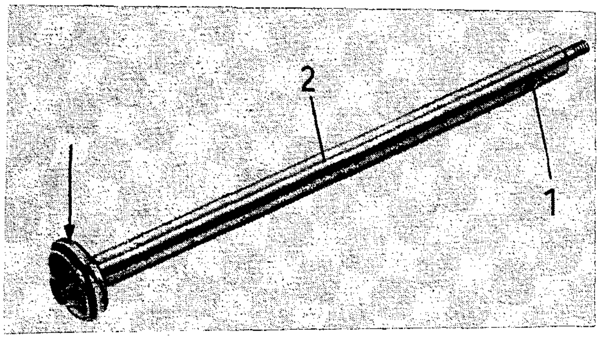


Fig. 112. Checking the supporting tube

- Check the supporting tube (2) (Fig. 112) for damage. No scores must be visible on the sealing surface of the Miramid piston ring (arrow-head) otherwise the damping pressure will be too low. The damping hole (1) of the supporting tube must be free from burr and its diameter must not be changed;
- The supporting tube (2), Fig. 112, is pushed into the checked guide tube (A) from below (valve side); prior to this, the Miramid piston ring is fitted with shock-absorber oil.

  Mount the thrust washer (2) and the lock ring (1) according to Fig. 111. Pay attention to the proper seat of the lock ring.

  Place the compression spring (5), having a diameter of 27 mm, against the lock ring and fit the valve plate (4) with the ground side pointing to the following throttle. Then smoothen the throttle (3) on one side, opposite to the radius and the milled-out recess, by means of fine emery cloth on a surface plate, and mount it with the smooth side pointing to the valve plate (Fig. 109).

  Fit the annular ring (1). For reasons of safety, only use new rings, and pay particular attention to the proper seat of the ring in the groove (see Fig. 109).
- Push the round piece of wood from above into the guide tube and push the supporting tube downward until the stop is reached, leave the round wood in the guide tube;

  Clamp the guide tube at its upper end, with the protective tube pointing upward, in a vice between soft protective jaws. The round wood still in the guide tube now backs the supporting tube from below. Fit the cup for the final stop (5), the compression spring (4) 19 mm in diameter, and the sealing washer (3) (Fig. 107).
- Apply some damping liquid to the guide tube for the shaft seal ring and push the sliding tube from top over the guide tube and fit, at the same time, the threaded piece of the supporting tube into the drill-hole in the sliding tube. Fit the corrugated washer (7) and the fastening nut (8) (Fig. 107) and tighten the latter.
- Push the protective bellows or the protective cap over the guide tube and insert the collar (A) into the groove (B) of the sliding tube. Prior to this clean the groove (B) in the sliding tube. The vent hole in the protective bellows must point to the rear. Fasten the protective bellows by means of a clip at its upper end.
- Insert the compression spring from top into the guide tube and fill in the specified amount of damping liquid.

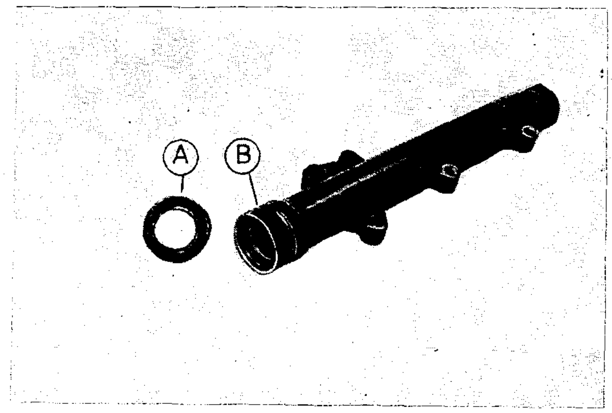


Fig. 113. Correctly fitted protective bellows or protective cap

Springs for the telescopic fork

Description	Unit	Solo	with Side-car
Length	mm	527	527
External diameter	mm	26	26
Wire diameter	mm	4.0	4.5
Turns	number	62.5	73.5
Spring constant	N/mm	4.06	5.9

5.3.7. Functional Test of Telescopic Fork

After mounting, the fork members must be subjected to a functional test for tightness and damping force. If a suitable testing equipment is not available, the test must be performed by vigorously contracting and extracting the components by hand. During expanding, the damping force must be distinctly perceptible. A trial run on a road of poor condition is also suitable as functional test.

The correct oil level is checked in the mounted condition of the telescopic fork according to Fig. 114.

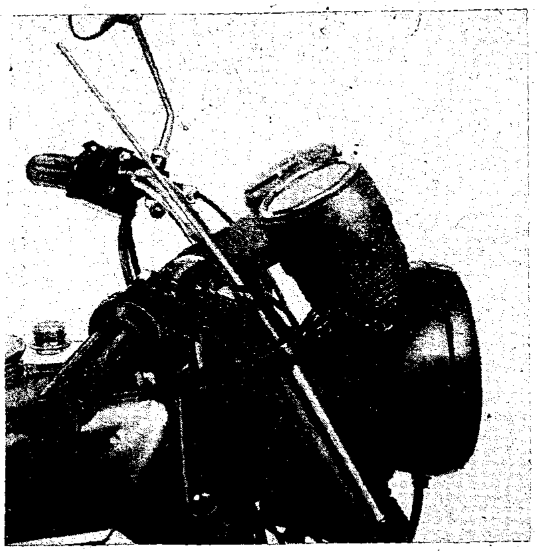


Fig. 114. Oil level checking

For oil level checking, the two screw plugs in the upper clamping head must be removed and the measuring wire (Ø 4 mm) inserted into the fork members in the centre of the compression spring. The measuring wire must get to the deepest point of the telescopic fork members, that is to say, it must be pushed through the supporting tube.
In any oil level checking or new filling, everything depends on equal levels in the telescopic fork members, otherwise the roadability will be impaired. The specified maximum oil levels must not be exceeded otherwise the pressure will become too high when the telescopic fork is compressed. For the oil quality observe Section 2.4.

The oil capacity per fork member is 230 cm^3.

Oil level (cm^3)	Height of the oil level (mm)
230 (solo)	≙ 330
230 (with side-car) depending on the load on the vehicle the oil filling can be increased to max. 265 cm^3 for the solo machine and to max. 235 cm^3 for the side-car machine	≙ 340
265 (solo)	≙ 395
235 (with side-car)	≙ 345

5.4. Fuel Tank

Because of the danger of explosion, repairs of fuel tanks can only be carried out when the relevant safety regulations are strictly observed.
The FRONT and REAR of the fuel tank is elastically fastened to the frame (Fig. 115).
As a consequence, the transmission of vibrations from the frame to the fuel tank is effectively attenuated. After the removal of the fuel tank, the rubber parts can be subjected to inspection.

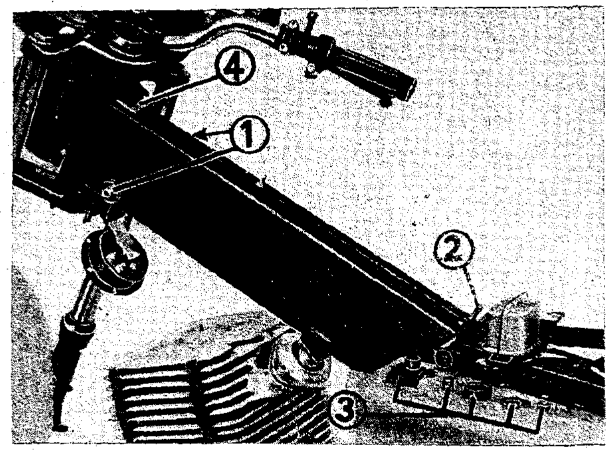


Fig. 115. Fastening the fuel tank
(1) Supporting pad, front
(2) Fastening screw, rear
(3) Fastening elements, rear
(4) Retaining rubber, front top

The elastic mounting of the fuel tank is not subject to essential wear. It must not be changed into a rigid mounting.

5.5. Fuel Shut-off Cock

The condition of the fuel shut-off cock exerts a considerable influence on the proper function of the engine. Insufficient fuel feed may also lead to piston seizing.

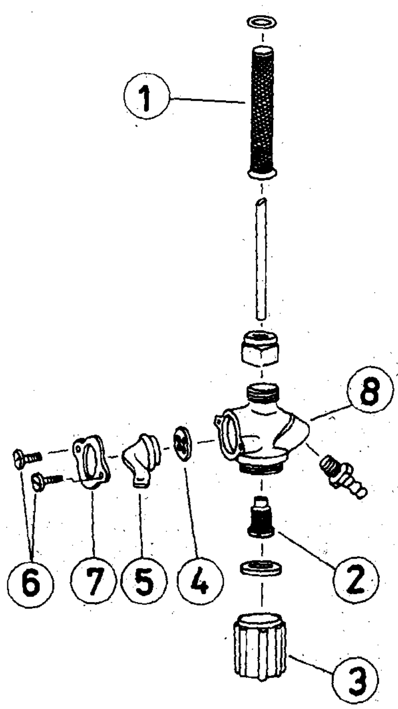


Fig. 116. Fuel filter cock, dismantled

In the cock, the fuel flows through two strainers. The first one is accessible (1) after unscrewing the fuel shut-off cock from the fuel tank; the second one after (2) the loosening of the filter bowl (3).

It is advisable to clean the strainers after every 5,000 km of road operation or once a year carefully.

Another cause of troubles in the fuel cock may be the rubber packing (4) under the actuating lever (5) whose drill-holes may be closed or clogged by swelling or by fastening screws (6) which are tightened too much.

Actuating lever and rubber packing can be removed after loosening the two retaining screws arranged on either side of the actuating lever.

On the occasion of repairs in the fuel cock, the fuel hose leading to the carburetter should also be checked.

When this hose has become brittle, leaks may occur in the points of connection. The, the fitting of a new fuel hose having the dimensions 5 x 8.2 mm is required.

NOTICE!

On no account should holding screws (6) be tightened until the spring plate (7) contacts the casing (8). The actuating (5) lever must be easily movable. When the fuel cock should drop, then tighten the holding screws (6) uniformly through maximum one revolution.
The rate of flow must be at least 12 litres per hour.

5.6. Rear-wheel Drive and Rear-wheel Hub

The design of the rear-wheel drive is shown in the Figs. 117 and 118. In contrast to the previous type, two radial grooved ball bearings are incorporated in this type of rear-wheel drive (see Fig. 118).

The chain cover contains a through bush (1) which enables to tighten the nut (2) - see Fig 117 - with the maximum permissible torque without destroying the cover.

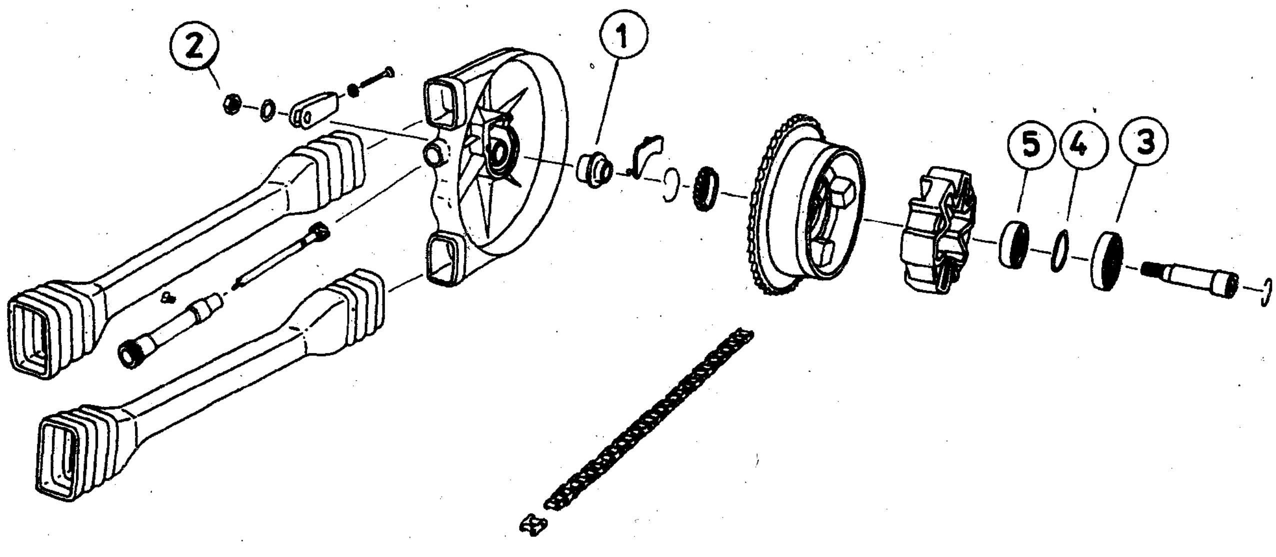


Fig. 117. Exploded view of the rear-wheel drive

Apart from a view corrections of shape, the rear wheel hub is equal to that of the preceding type.

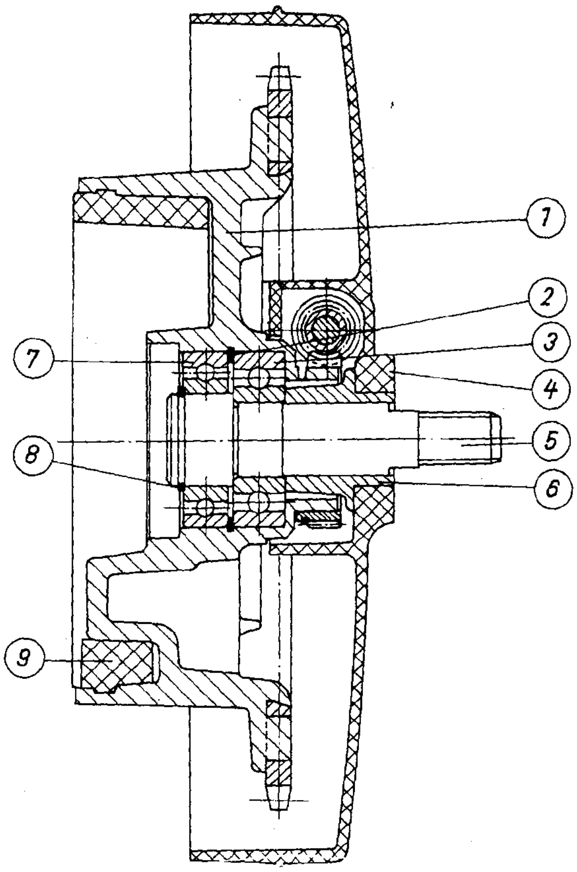


Fig. 118. Rear wheel drive

(1) Damping body
(2) Lock ring
(3) Bearing 6204
(4) Chain covering
(5) Flanged bolt
(6) Bushing
(7) Bearing 6005
(8) Circlip
(9) Damping rubber

5.6.1. Dismantling the Rear-wheel Drive

For this purpose, the rear wheel and the rear-wheel drive must be removed from the vehicle. At first drive out the flanged bolt (see Fig. 119).

Then heat the rear wheel drive to about 100 °C. The 6005 bearing (3) can be pressed out by means of an offset screwdriver. Take out the lock ring 47 (4) and, finally, drive out the 6204 bearing (5) (Fig. 117).

After once more heating the rear wheel drive, mount the parts in the inverse order of the dismantling operations.

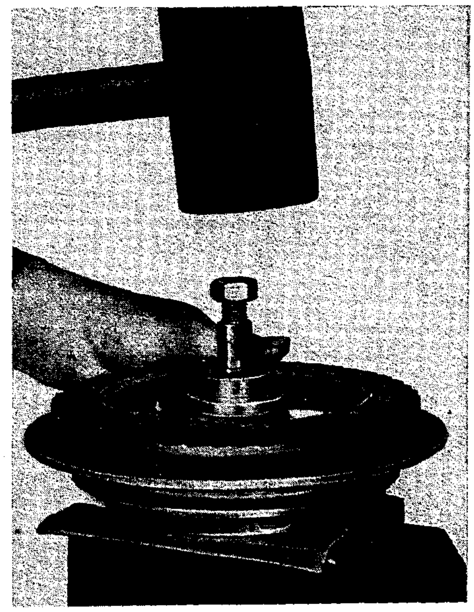


Fig. 119. Driving out the flanged bolt

5.6.2. Speedometer Drive

Fig. 120 gives a sectional view of the speedometer drive.
The pertinent helical gear is fastened to the damping body with ring gear by means of a hooked circlip. The pinion of the speedometer drive is replaced by unscrewing the countersunk screw (5) from the chain cover and pulling out the bearing bush (6) together with pinion (3) and (7) towards the rear.
During assembling, the pinion, the pinion shank and the helical gear must be provided with antifriction bearing grease and then fitted.

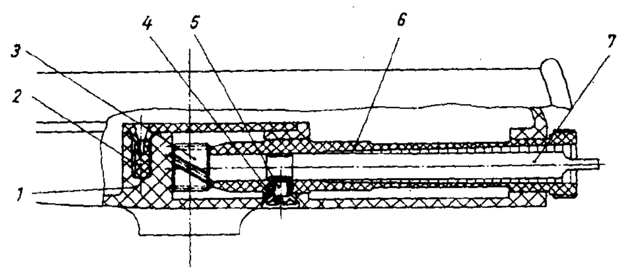


Fig. 120. Speedometer drive (sectional view)

(1) Chain cover
(2) Packing
(3) Pinion body
(4) not applicable
(5) Countersunk screw BM 6 x 8
(6) Bearing bush
(7) Pinion for speedometer drive

5.7. Changing the Wheel Bearings

With the help of an expanding mandrel (special tool H 8-820-3), demounting the wheel bearings is facilitated. For this purpose, the wheel body is slightly heated. After driving in the expanding mandrel, the wheel bearings are diven out towards the outside (Fig. 121). For mounting, the wheel bodies must also be heated. On no account should the spacer sleeve between the bearings be forgotten. Moreover, ball bearings with sheet-metal cage should only be used; the type of ball bearing is 6302.

When re-fitting the complete wheel, take care that the rubber seal ring at the wheel bearing on the brake side is not forgotten. This seal ring is desinged to prevent the lubricant of the wheel bearing from being thrown into the brake.

The wheel bearings have to be mounted with antifriction bearing grease.

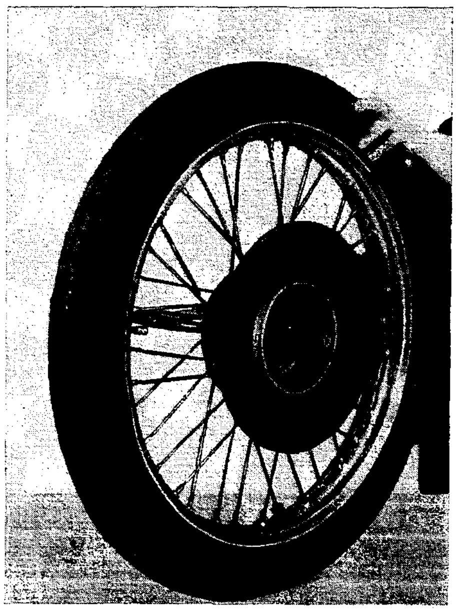


Fig. 121. Driving out the wheel bearings

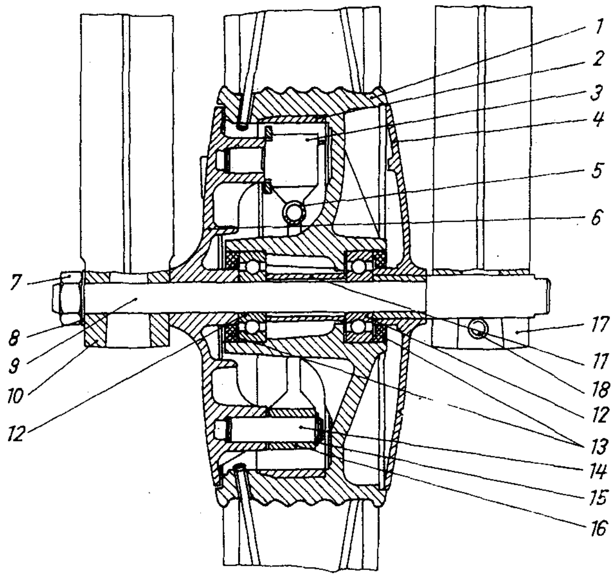


Fig. 122. Front wheel hub (sectional view)

(1) Wheel body with cast-in brake ring
(2) Brake ring
(3) Brake lever
(4) Wheel body cover
(5) Return spring for brake shoe
(6) Brake back rest
(7) Hexagon nut M 14 x 1.5
(8) Washer
(9) Axle
(10) Axle accomodation, right
(11) Spacer sleeve
(12) Ball bearing 6302
(13) Rubber packing
(14) Anchor bolt
(15) Lock ring 12
(16) Brake shoe
(17) Axle accomodation, left
(18) Hexagon-head screw for clamping the axle

5.8. Brakes

5.8.1. Internal Shoe Brake

The anchor bolts (1) tightly fit in the brake back rest. The brake shoes (2) are pivoted on the anchor bolts and the cam spindle (3) in the brake back rest (Fig. 123).

As experience has shown, wear is insignificant in the bearing of the brake shoes; it is necessary, however, to clean the bearings and provide them with hot bearing grease every 10,000 km or at least once a year. This also applies to the bearing of the cam spindle in the brake anchor plate.

When replacing the brake shoes, which are capable of bein regenerated, take care that already tooled brake shoes can be mounted while non-tooled brake shoes have to be tooled in a lathe before mounting. For this purpose, they must be fastened on the brake back rest with the help of the return spring (4). The brake back rest

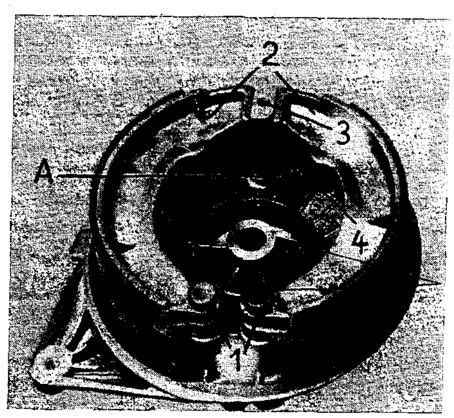


Fig. 123. Brake anchor plate, complete
(a) Ground contact for stop light (also for front-wheel brake)

is centred in the bore and the shoes have to be tooled in a lathe until the difference between the diameter of the brake ring and the diameter of the brake shoes is at least 0.6 mm.

5.8.2. Disk Brake for the Front Wheel

The fixed-saddle brake is hydraulically actuated by means of a lever at the brake master cylinder. The arrangement of the components is shown in Fig. 124.

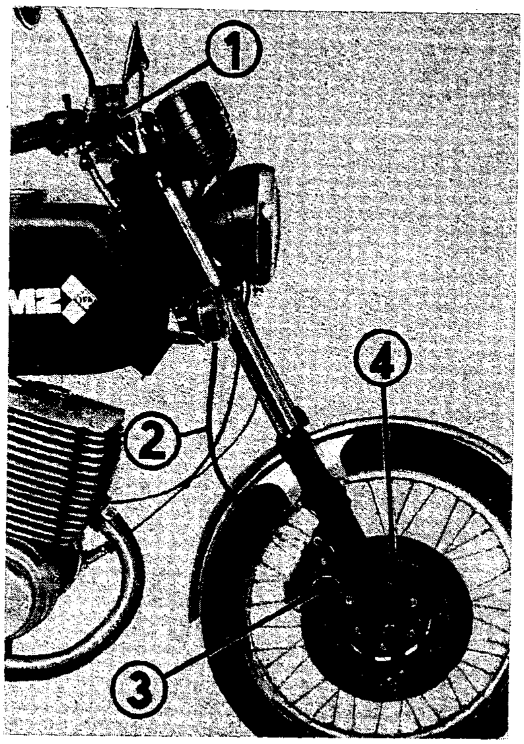


Fig. 124. Arrangement of the disk brake

(1) Brake master cylinder
(2) Brake hose
(3) Brake saddle
(4) Brake disk

In an exploded view, the Figs. 125 and 126 show the arrangement of the parts of brake saddle and brake master cylinder.

Demounting and Mounting the Brake Master Cylinder

- Disconnect the cable connections from the stop light switch,
- Loosen the brake hose for about 0.25 revolutions,
- Unscrew the brake master cylinder from the handle-bars,
- Remove the screw cap and the hermetic bellows and decant the brake liquid,

Completely unscrew the brake hose.

For mounting, at first loosen the screwing of the brake hose (union nut) in order that the brake hose is not twisted during screwing in. Tighten all screwed joints, fill in brake fluid and bleed the brake.

Repair of the Brake Master Cylinder

Remove the hand brake lever. Then use compressed air, which must be admitted through the hose connection hole, to press out the internal parts of the brake master cylinder. With one of your hands prevent these parts from being flung away.

Scores in the sliding surfaces of cylinder and piston are signs which call for a replacement of the complete brake master cylinder. If only the packing rings are defective, the brake master cylinder can be assembled when using a new set of packing rings. Absolute cleanliness is necessary. Wetten all sliding surfaces and packings with brake fluid and demount the parts according to Fig. 125. Push the retaining ring of the end packing ring by means of a sleeve (pipe diameter = 18 mm x 16 mm x 30 mm) until it engages with the groove provided for this purpose.

Fasten the hand brake lever in such a way that it can be moved easily and free from any play in its holder. Adjust the play between piston and hand brake lever to about 0.5 mm by means of an adjusting screw.

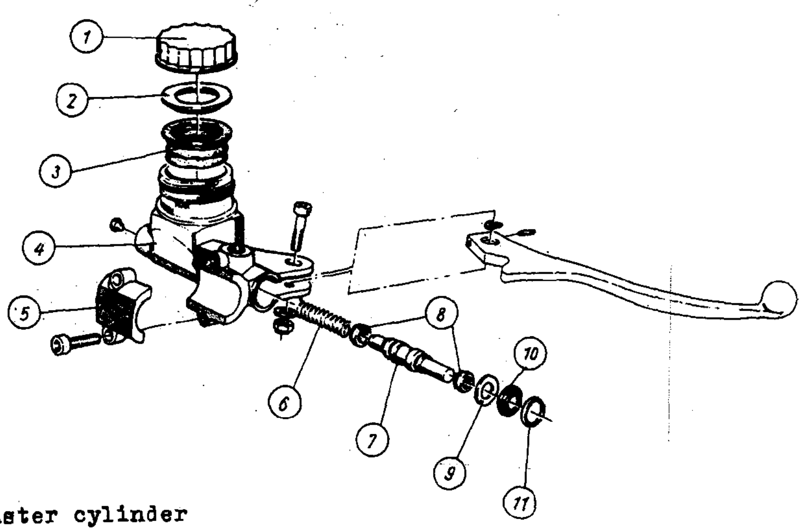


Fig. 125. Brake master cylinder

(1) Cover
(2) Vent ring
(3) Hermetic bellows
(4) Housing
(5) Fastening clip
(6) Spring
(7) Brake piston
(8) Sealing sleeves
(9) Washer
(10) Packing
(11) Circlip

Demounting and Mounting the Brake Saddle

- Remove the brake hose by loosening the union nut. Fasten the hose to the telescopic fork with binding wire.

NOTE: The hose opening must not be deeper than the liquid level in the reservoir of the hand brake cylinder!

- Demount the brake saddle from the sliding tube of the telescopic fork.

Mount the parts in the inverse order. If required, top up with brake fluid, bleed the brake.

Repair of the Brake Saddle

- Remove the cover
- Drive out the two bolts by means of a mandrel from the side of the small bolt diameter
- Remove the brake shoes
- Dismantle the brake saddle
- Press out the brake piston by means of compressed air

As to the discarding of parts, the same criteria apply as for the brake master cylinder.

Mount the absolutely clean parts in the inverse order. Apply brake fluid to the sliding surfaces and internal packing rings before mounting them.

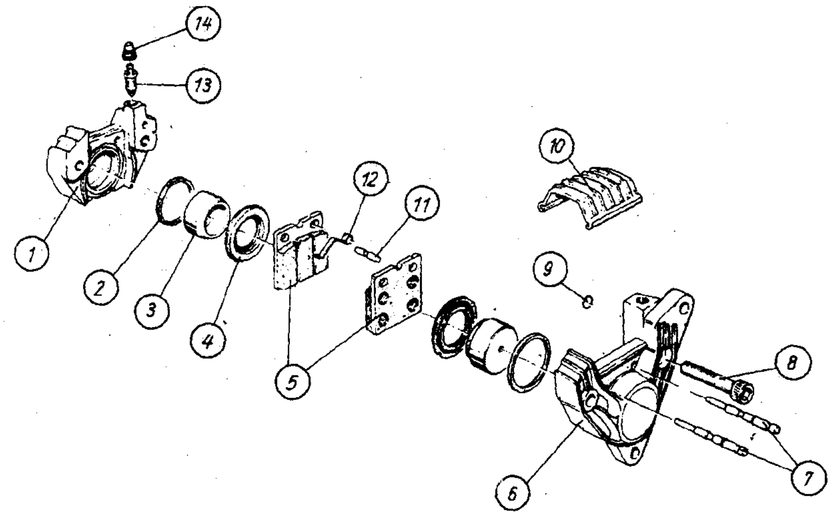


Fig. 126. Brake saddle of the disk brake

(1) Inner brake cylinder
(2) Packing ring
(3) Brake piston
(4) Packing sleeve
(5) Brake shoe
(6) Outer brake cylinder
(7) Guide bolt
(8) Hexagonal socket-head bolt
(9) Packing
(10) Cap
(11) Taper pin
(12) Spring
(13) Vent screw
(14) Protective cap

Replacement of the brake shoes

Replace the brake shoes in the following order of operations, when they are worn down to the wear marking.

- Remove the front wheel
- Remove the brake shoes in the manner described in Section "Repair of the Brake Saddle"
- Externally clean the brake saddle
- Press back the brake piston
- Mount the new brake shoes
- Fit the front wheel

NOTE: Do not actuate the brake when the brake shoes are removed!

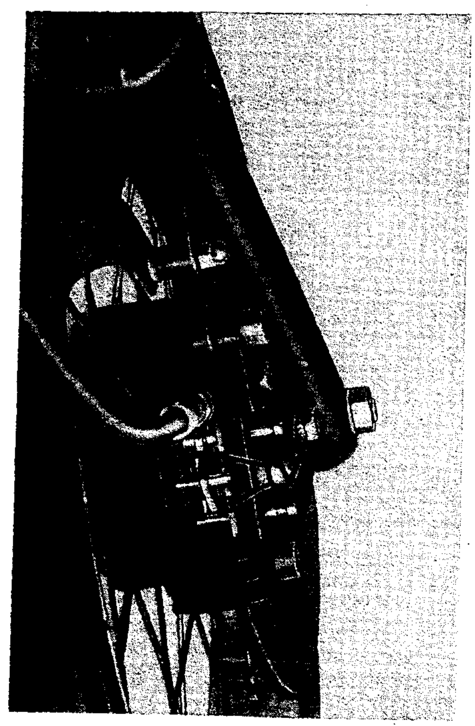


Fig. 127. Brake shoe - wear marking
V = wear groove

Replacing the Brake Disk

The brake disk must be replaced when it is worn down to less than 4.4 mm or when it shows scores whose bottom is such that the actual thickness falls below the above minimum thickness.

NOTE: For reasons of safety, use new self-locking nuts whenever mounting the brake disk!

Before mounting the wheel provided with a new brake disk, press back the brake pistons into the brake saddle.

Replacement of the Brake Fluid

After about two years, the brake fluid must be renewed. This can be done with the help of a filling apparatus or in the following way:

- Put a suitable hose on the bleeder valve of the brake saddle
- Open the bleeder valve. By pumping continuously with the hand brake lever, evacuate the brake system through the hose into a suitable vessel
- Fill in brake fluid
- Bleed the brake system

Filling in Brake Fluid

When a new brake system has been newly installed or repaired or when the brake fluid must be renewed, the filling of new brake fluid can be effected with the help of a filling apparatus or in the following way:

- Remove the cover and the hermetic bellows from the brake master cylinder
- Provide the hose (1 m in length) with a funnel and put the hose on the bleeder valve
- Open the bleeder valve
- Raise the hose so that the funnel is about 20 cm above the top edge of the reservoir and fill in brake fluid until the maximum level has been reached in the reservoir
- Close the bleeder valve
- Fit the hermetic bellows and screw the cover in place
- Bleed the brake.

Bleeding the Brake

The brake is bled automatically. This process lasts for about an hour with the reservoir opened. The last remains of air escape when slightly tapping brake saddle and brake hose. Then fit the hermetic bellows and screw the cover in place.

More rapid bleeding is effected in the following way:

- Close the reservoir
- Put the filling hose on the bleeder valve and fill it up to the half of the funnel
- Raise the hose (funnel about 20 cm over top level marking of the brake master cylinder)
- Open the bleeder valve through half a revolution and, at the same time, pull the hand brake lever up to the stop. Close the valve with the hand brake lever pulled
- Repeat this process until no air bubbles will emerge. The liquid level must not fall below the lower level marking.
- Finally, fill the brake master cylinder up to the top marking. Fit the hermetic bellows and screw the cover in place.

Faults in the Brake System

Fault	Possible Cause	Remedy
Braking effect insufficient	brake disk dirty	braking at intervals until brake disk is dry
	brake lining oiled up	replace brake shoes
	piston sticks in brake saddle	free the piston and restore it to proper operation or replace brake saddle, change brake fluid
No counterpressure at hand brake lever	air in brake system	bleed the brake system
	brake lines and/or brake cylinder leaky	seal the brake lines and the brake cylinder or replace them by new ones
	amount of brake fluid insufficient	top up brake fluid
	compensating hole in reservoir covered - brake fluid cannot be fed as required	adjust the play at the hand brake lever
Brake fails to stop	brake disk worn	replace the brake disk by a new one
	underpressure in reservoir	open the cover, clean the vent hole
Brake lever moves during braking	difference in thickness of brake disk	replace the brake disk by a new one

Fault	Possible Cause	Remedy
Brake fluid level drops	brake lines and/or brake cylinder leaky	seal the brake lines, replace the packings in the cylinders or replace brake master cylinder and brake saddle by new ones
	brake shoes worn	replace brake shoes
	brake hose porous or defective	replace brake hose by a new one
Resistance offered by hand lever diminishing when brake temperature is high	brake fluid contains formation of water vapour bubbles	replace the brake fluid by new one
Brake fluid contains water	Interval for change of brake fluid not observed	observe Maintenance Chart
	hermetic bellows not fitted or it is defective	fit the hermetic bellow or replace it; change the brake fluid
Stop light fails when actuating the front wheel brake	cable interrupted, plugged connection oxidised, stop-light switch defective	repair the connections, change the stop-light switch

5.9. Secondary Chain

The placing of a new chain on the vehicle is shown in Figs. 128 to 130.

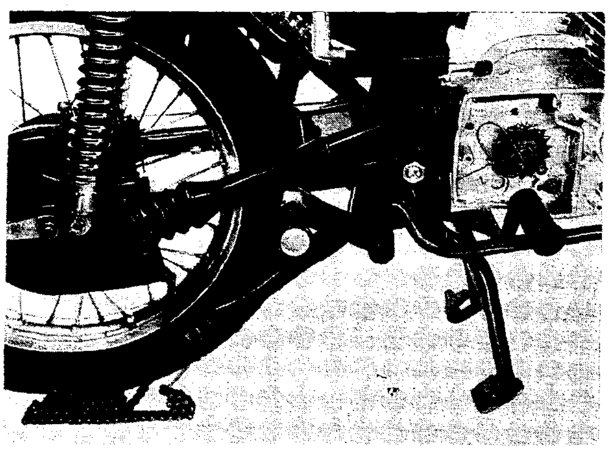


Fig. 128. Fitting a new chain - 1st step

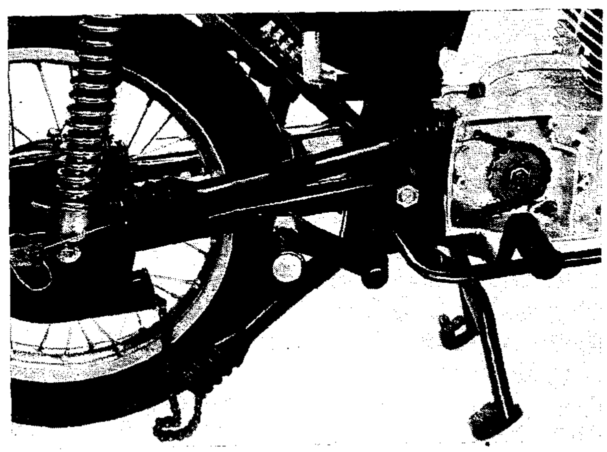


Fig. 129. Fitting a chain - 2nd step

The two chain protection hoses are fist pushed on the engine casing. For placing on the rear sprocket, the chain is pulled through from top to bottom. The upper end is fixed by means of a spoke pushed through the chain. Then use a wire hook to pull the chain from the rearto the front (through the lower chain protection hose) and place i round the front sprocket wheel.
Finally, the chain is pulled by means of a wire hook from the front to the rear through the upper chain protection hose and then connected together by means of the chain connector.

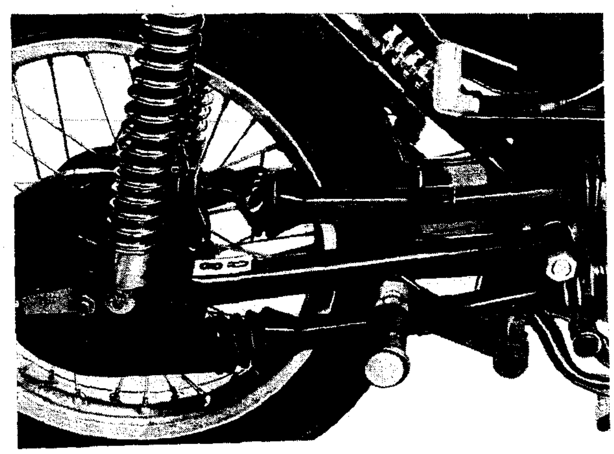


Fig. 130. Fitting a chain - 3rd step

In this connection, the upper chain protection hose must be pushed slightly ahead and retained by means of a spoke (Fig. 130). Pay particular attention to the position of the chain connector:

OPENING TO THE REAR!

When replacing a chain, the new chain must be tied to the old one and then pulled through by the latter one. A replacement of the chain is required when more than 5 rollers are broken or more than 2 rollers side by side are broken or when the chain bolts in the chain links are worn.
When a chain of a different make is used, the chain connectors of this make must be used because the bolt diameters may differ.



Fig. 131. Checking the chain tension

When replacing a chain, the sprocket wheels must also be checked.
When they are worn, they must be replaced, too.
Correct chain tension and chain lubrication exert a great influence on the service life of the chain.
A correct chain tension is ensured when the upper chain protection hose with the cahin inside can be pressed with two fingers, without undue force, on to the cross tube of the rear-wheel swing-fork. Check for one full revolution of the chain!
The rear wheel suspension units must be fully extracted (the motor-cycle is standing on the prop stand). When the chain seems to be too slack, it should be taken into consideration that the chain becomes more taut when the springs of the rear wheel are compressed.

Lubrication of the chain is necessary every 2,500 km.

With the dynamo cover removed, antifriction bearing grease Ceritol + k2 or k3 is applied to the lower part of the chain by means of a screwdriver while the rear wheel is turned slowly in travel direction through one full revolution of the chain; then apply the same amount of grease to the upper part of the chain and turn the rear wheel opposite to the normal sense of rotation.

5.10. Exhaust System

The exhaust system is adapted to the engine in such a way that, firstly, the desired performance characteristic is attained and, secondly, the permissible noise limit is observed. Therefore, no changes should be made in the exhaust system.

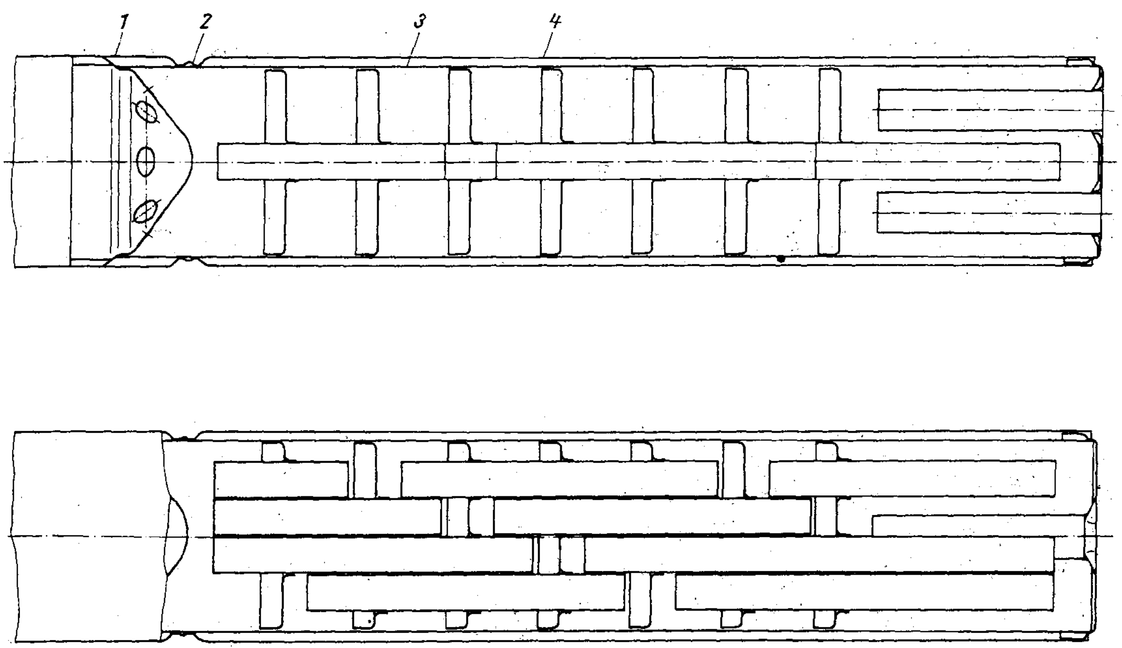


Fig. 132. Sectional view of exhaust silencer
(1) Exhaust pipe (2) Weld
(3) Damping insert
(4) Exhaust tail piece

The exhaust silencer (Fig. 132) is welded and cannot be detached.
The exhaust pipe is fastened to the cylinder by means of a union nut which presses the tapered knurled collar against the cylinder

(without packing). In new condition, the union nut is tightened with a torque of 150^{+30} Nm (15^{+3} kpm).

After having covered 500 km, the nut must be re-tightened in any case with the same torque because, during this distance, the taper of the exhaust pipe will attain proper contact with the supporting surface of the cylinder and the thrust area of the union nut.
Re-tightening is effected by means of a hook spanner, B 39-442, and an extension pipe put on.
A proper exhaust pipe fastening largely depends on the tightly fitting of all three suspension points (cylinder, lower connection, rear brace). When one of these points is defective, the stress on the other two will increase and they will work loose.
The rubber bearings of the brace must not be replaced by a rigid connection because of the elastic engine suspension.

5.11. Aligning the Wheels, Balancing the Front Wheel

Correctly aligned wheels are indispensable for good roadholding.
Since the front tyre is not so wide as the rear tyre, the front wheel must be set parallel to the measuring lath.

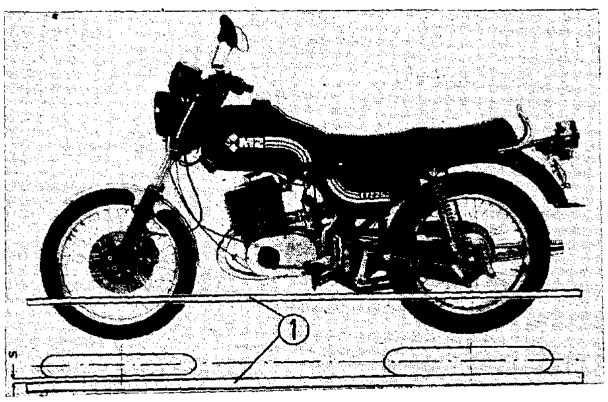


Fig. 133. Aligning the wheels
(1) Measuring lath
(S) Gap between lath and front wheel

To improve the roadability, the front wheel is balanced in series production. In case of a puncture, the tyre must be fitted in the same position with respect to the rim as before, that is to say, the red dot must be at the valve.

Due to non-uniform wear, the front wheel may get out of balance after a prolonged time of operation, therefore, the wheel must be balanced again after every 10,000 km.

For balancing, the wheel is allowed to come to rest in a slightly raised position with the bearings free from grease on the wheel axle and then counterweights are attached (either MZ balancing bodies or lead or copper wire) to the spoke nipples at that point of the wheel which remains on top when the wheel is at rest.

5.12. Cable Controls

The cable controls are exposed to external influences such as rain, dirt and lye in a high degree on the motor-cycle. In motor-cycles which are operated daily and frequently parked in the open, high friction occurs in the cable controls so that the actuating levers can hardly be pulled.

Ease of motion is improved and the service life extended when the cable controls are sealed at the actuating levers and thoroughly lubricated to prevent the ingress of water and dirt.

The simplest way of sealing is the application of water-repellent grease, e.g. Ceritol, to the projecting wire end and to the slot in the adjusting screw of the actuating lever.

An additional possibility of extending the service life of the cable controls is given by attaching a rubber protective bellow, part No. 05.44.050; the interior of the bellows is filled with a water-repellent grease.

The cable controls are lubricated by means of the device shown in Fig. 134.

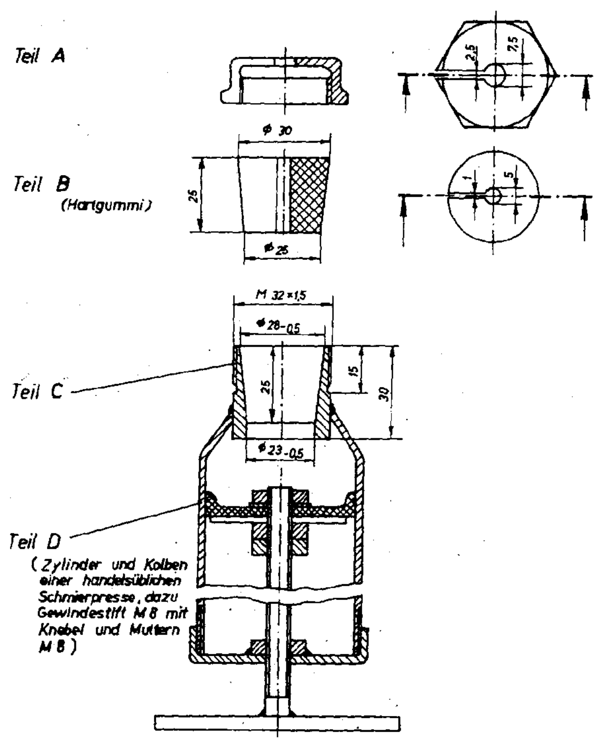


Fig. 134. Device for lubricating the cable controls

As lubricant, either a mixture of gear oil and gear grease in the mixing ratio of 1 : 3 or a mixture of antifriction bearing grease Ceritol + k3 and fuel in the mixing ratio of 1 : 1 is used.

One end of the sheath of the cable controls is clamped in the taper rubber cap and, together with the rubber cap, screwed on the device with the help of a union nut.

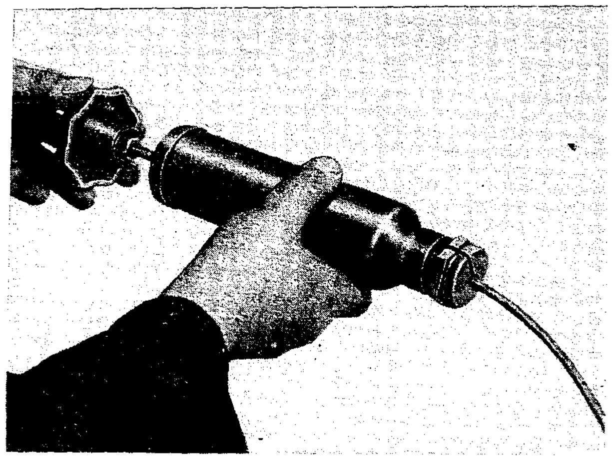


Fig. 134a. Cable control clamped in a lubricating device

6. Electrical Equipment

6.1. Three-phase Dynamo

6.1.1. Mode of Operation

The traffic growing denser and denser and the trend toward increasing the safety on the road by the use of halogen light, additional fog lamps and rear fog lights also on motor-cycles lead to an increase of the demand for electrical energy.

This increased demand cannot be met by the d.c. dynamo with reasonable costs and due to increased engine speeds.

Compared with this, the three-phase current dynamo of the same weight is in a position to produce a considerably higher power.

Three-phase dynamos have no commutator, the output current is drawn from the stator winding without contact. Only a small exciter current, branched off via 3 exciter diodes, is transmitted to the rotor via 2 carbon brushes and slip rings so that operation at high rotational speeds is possible.

The alternating current drawn from the stator is converted into direct current by an efficient three-phase bridge rectifier.

Due to the use of modern silicon semi-conductors, it ensures maintenance-less operation and a long service life.

The bridge rectifier is a separate component on which the exciter diode trio is also mounted.

The supplied voltage is kept at the desired level by means of an electromechanical one-element regulator. At the same time, the maximum current is limited by the regulator.

When observing the regulator voltage and the mounting conditions required in the technical documents, protection of the three-phase dynamò from destruction and a long service life of the electrical equipment are ensured.

6.1.2. Technical Data

Identification No.	8046.2
Dynamo voltage	14 V
Idling speed	≧ 1,300 rpm
Speed at 2/3 of the maximum current	≧ 2,200 rpm
Maximum speed	10,000 rpm
2/3 of the maximum current	10 A
Maximum current	15 A
Resistance of the rotor winding	4.2 ± 0.3 ohm
Length of carbon brush	16 mm
Length of carbon brush (minimum)	9 mm
Carbon-brush spring force	1.4 to 3.2 N (0.14 to 0.32 kp)
Slip rings (minimum diameter)	31 mm
Eccentricity	0.05 mm
Tightening torque for rotor fastening screw	20 ± 2 Nm (2 ± 0.2 kpm)
Sense of rotation (viewing the slip ring body)	clockwise
Polarity	mass negative

6.1.3. Technical Characteristic

The three-phase dynamo is a three-phase 8-pole synchronous generator in star connection.

The rotor carrying the exciter winding and the slip rings is fastened to the taper end of the crankshaft of the driving engine. The stator accomodating the polyphase winding is centred in the engine casing and, together with an aluminium die-casting cap carrying the ignition device and the carbon-brush holder, fastened by 3 screws passed via the external diameter of the stator.

The three-phase current is rectified in a rectifier in three-phase bridge connection.

The exciter current for the production of the magnetic field is branched off from the stator winding and rectified by 3 additional exciter diodes and 3 negative power diodes.

The excitation current is fed to the excitation winding from terminal 61 via the regulator, the carbon brushes and the slip rings. The regulator keeps the dynamo voltage constant and limits the maximum current.

The three-phase dynamo exhibits good self-excitation properties. Operation without battery is possible.

Ignition device: Contact breaker with ignition capacitor. With pertinent cam, one ignition pulse per camshaft revolution.

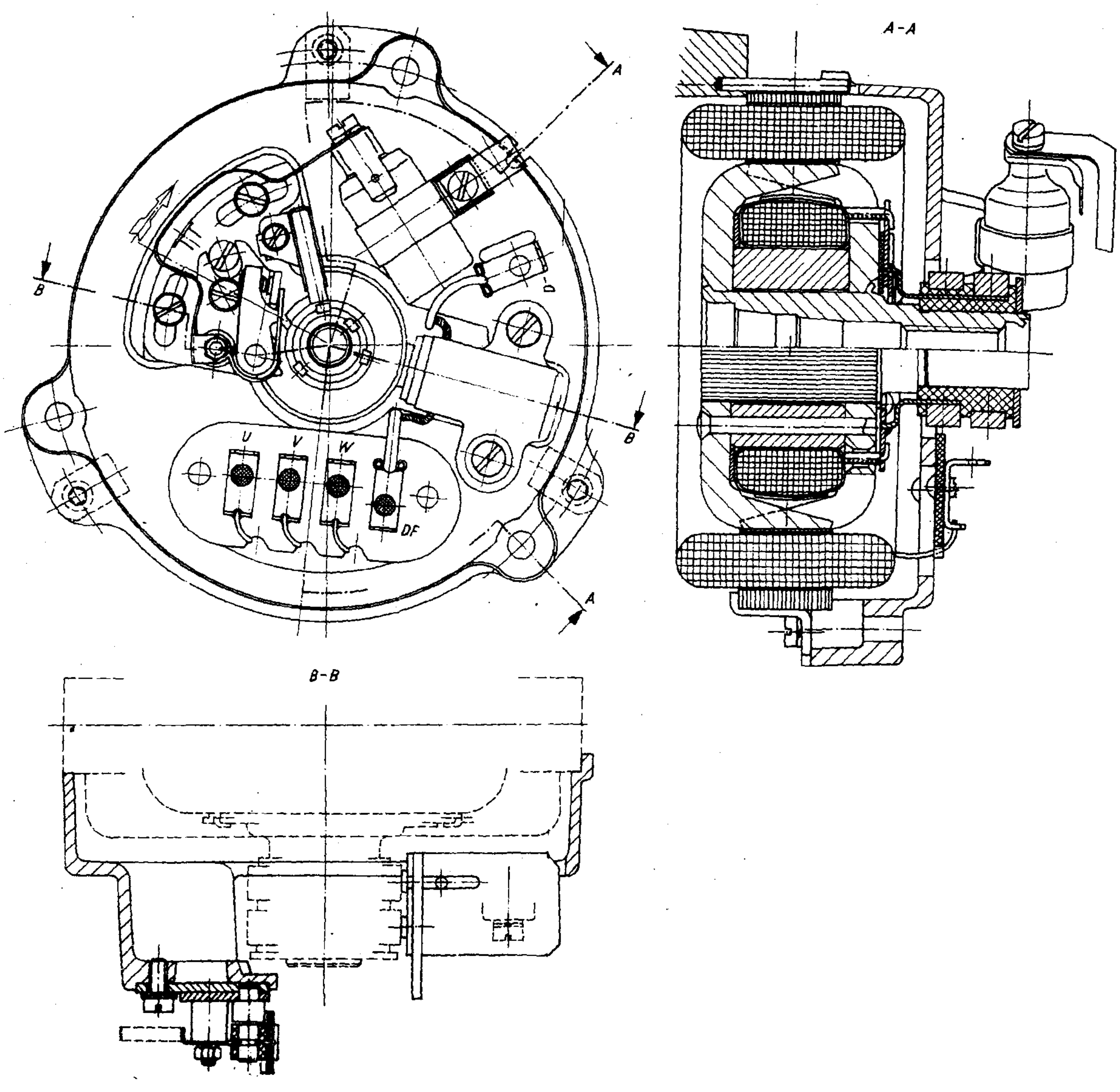


Fig. 135. Three-phase dynamo
12 V, 15 A

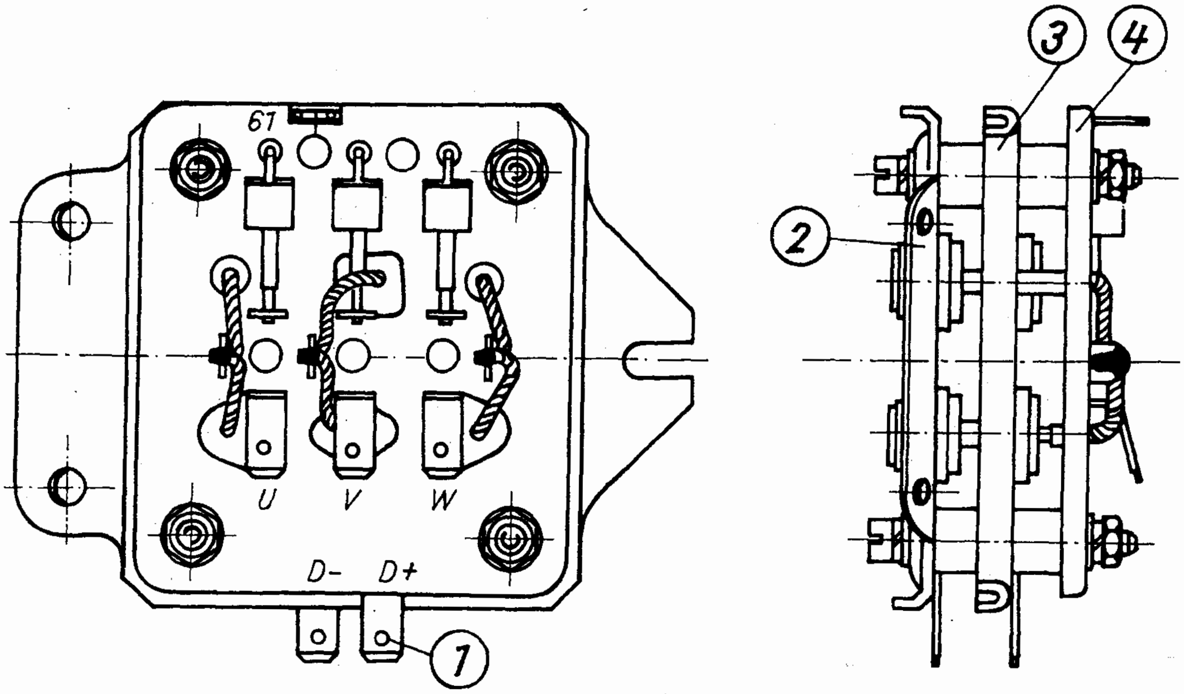


Fig. 136. Rectifier for three-phase dynamo 12 V, 15 A
(1) 6 x flat plug connection 6,3 TGL 22 425
(2) diode plate (negative)
(3) diode plate (positive)
(4) insulating plate with excitation diodes

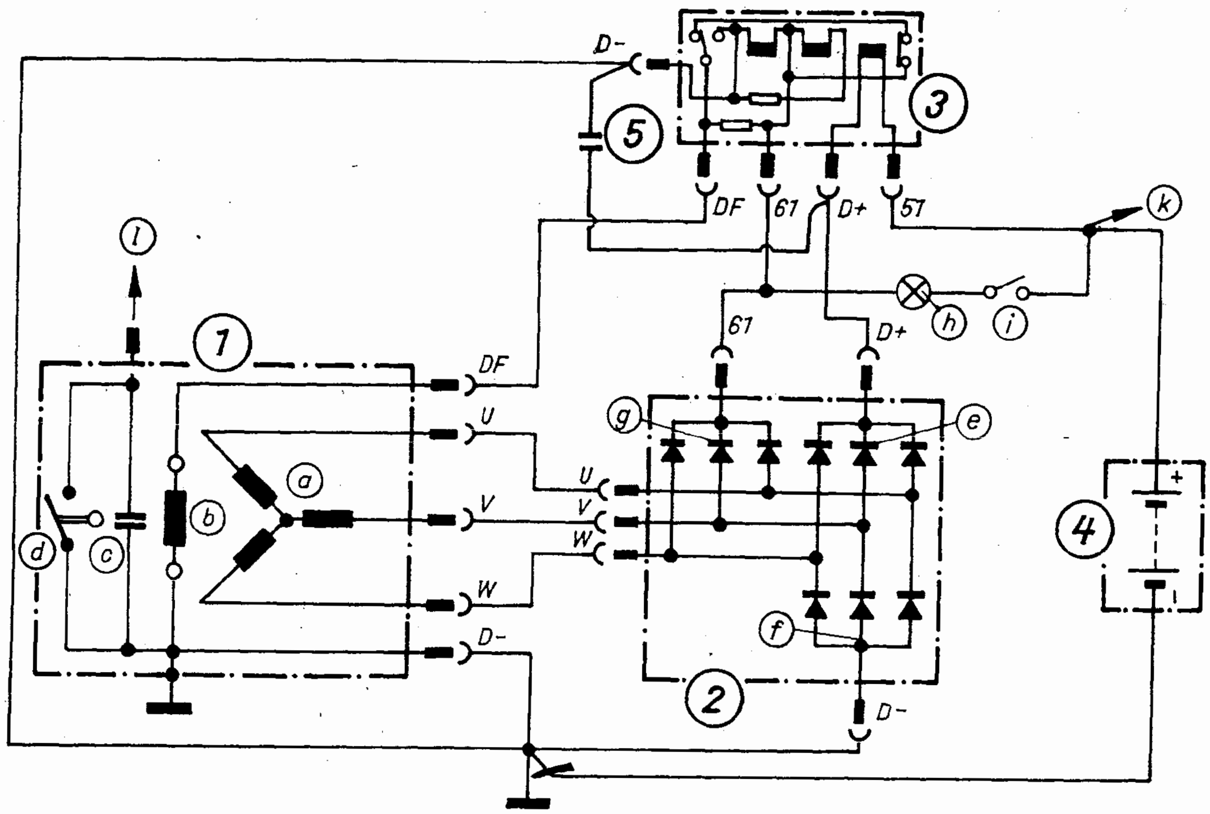


Fig. 137. Circuit of dynamo, rectifier and regulator

(for legend see page 68)

Legend for Fig. 137

(1) Three-phase dynamo

a) Stator
b) Rotor
c) Ignition capacitor
d) Contact breaker

(2) Rectifier

e) Positive diodes
f) Negative diodes
g) Excitation diodes
h) Control light
i) Ignition switch
k) to the loads
l) to the ignition coil

(3) Regulator

(4) Battery

(5) Capacitor 2.5 µF, 50 V

6.1.4. Fault Diagnoses

Below sequences of operations are described which serve for locating defects in the current supply system within a short time.
The method is to be selected according to the case in question.
Faults in the current supply system are in general indicated by the occurrence of one of the following deviations:

a) Abnormal behaviour of the charging control light;

b) Insufficiently charged battery. Indicated by the failure to start of the serviceable engine and by the low density of the battery acid;

c) Excessively charged battery; indicated by a high water consumption and boiling battery acid;

d) Emission of noise due to mechanical wear of the carbon brushes and slip rings or rubbing of the rotor at the stator parcel.

6.1.5. Behaviour of the Charging Control Light

Ignition switch	Charging control light	Engine	See Section 6.1.7.2.
According to specifications			
Off	Off	stopped	
On	On	stopped	
On	Off	running	
Erroneous			
Off	On	stopped	Part I
On	Off	stopped	Part II
On	reduced brightness	stopped	Part III
On	On	running	Part IV

6.1.6. Measuring Instruments

Instrument	Application
Autolicht-Prüf-Fix 12 V (test lamp with voltage source)	line testing, diode testing
Multimeter	voltage measurement, diode testing
Resistance measuring bridge after Thomson	resistance measuring at stator
Resistance measuring bridge according to Wheatstone	resistance measurement at rotor
Oscillograph	judgement of curve shape of voltage of three-phase dynamo according to Section 6.1.7.1.

6.1.7. Measurements at the Vehicle

Most of the faults can be identified even with the electrical devices installed.
The most rapid and exact indication can be obtained by means of an oscillograph. Practically all faults occurring in the three-phase dynamo and in the rectifier can be derived from the displayed curve shape.

During measurement, the engine must be operated with at least 3,000 rpm.
If an oscillograph is not available, a multimeter (e.g. UNI 7) should be used according to Section 6.1.7.2.

6.1.7.1. Use of an Oscillograph

The oscillograph must be connected to terminal D+ and ground. All load with the exception of the ignition system must be switched off. The battery remains connected.

NOTICE: When employing an oscillograph without d.c. voltage amplifier, the curves will appear on the Zero line of the oscillograph (see Fig. 138)!

All curve shapes deviating from the Figs. 138 and 139 are indicative of errors.

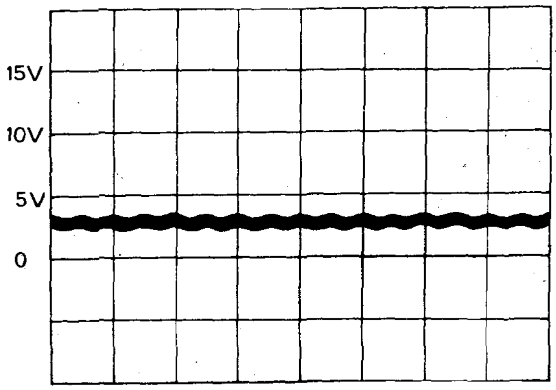


Fig. 138.Normal operation of the three-phase dynamo - oscillograph without d.c.voltage amplifier

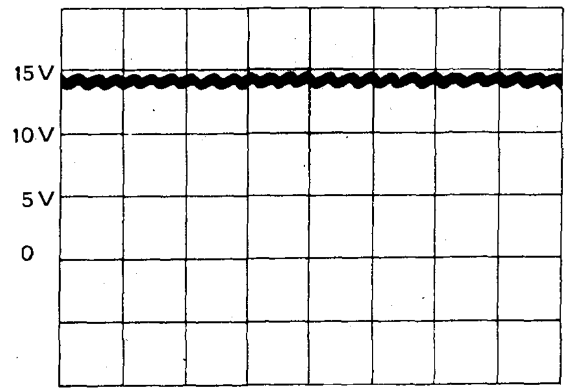


Fig. 139. Normal operation of the three-phase dynamo

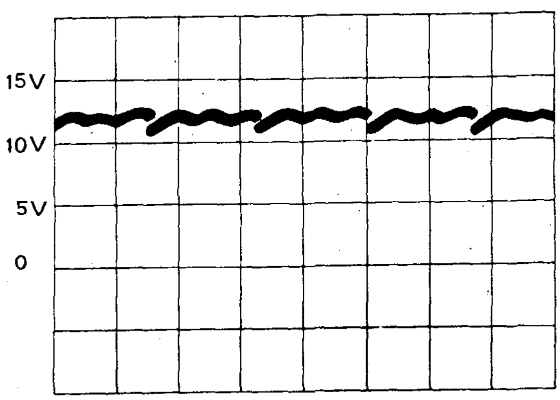


Fig. 140. Short-circuit of positive diode

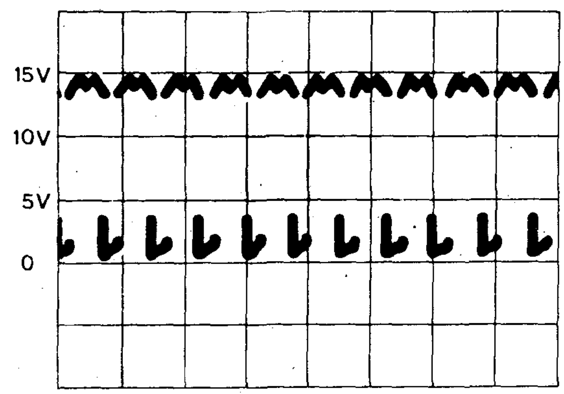


Fig. 141. Short-circuit of negative diode

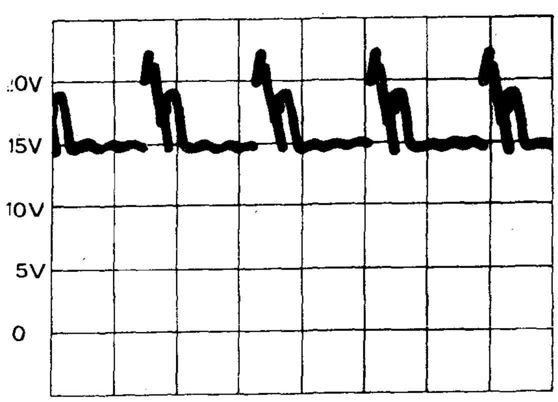


Fig. 142. Interruption of positive diode

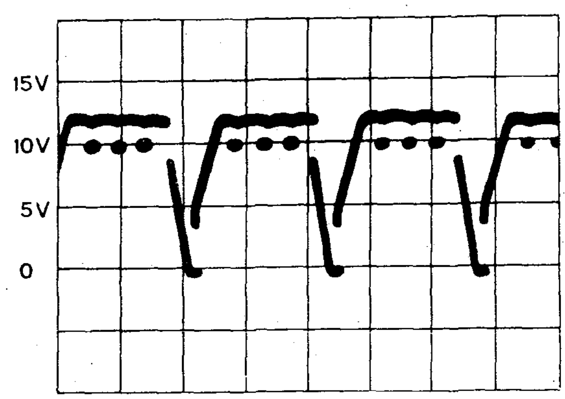


Fig. 143. Interruption of negative diode

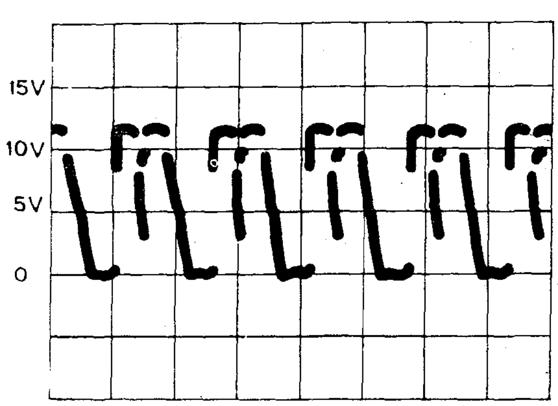


Fig. 144. Short-circuit of excitation diode

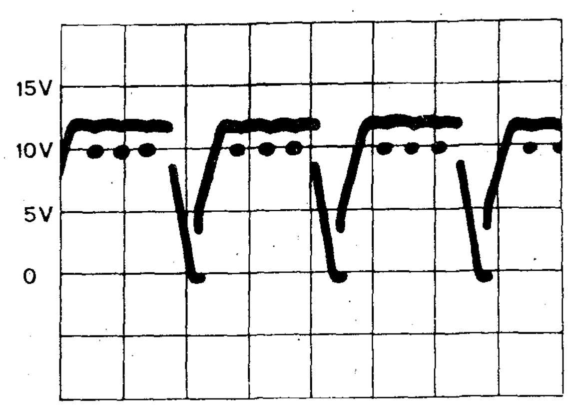


Fig. 145. Interruption of excitation diode

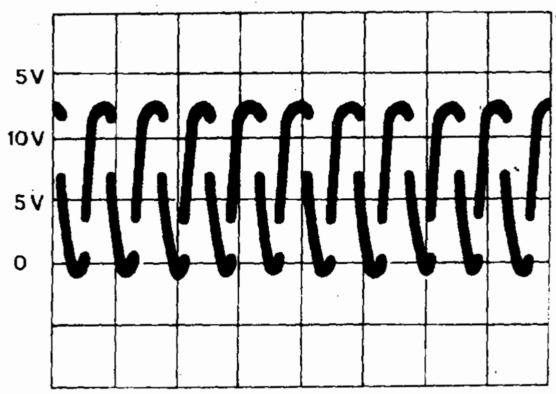


Fig. 146. Short-circuit of stator winding

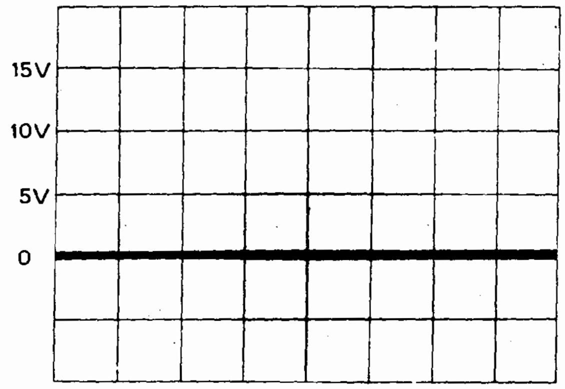


Fig. 147. Short-circuit of rotor winding

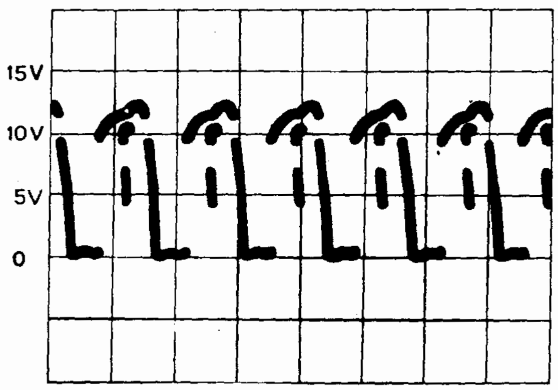


Fig. 148. Ground contact of stator winding

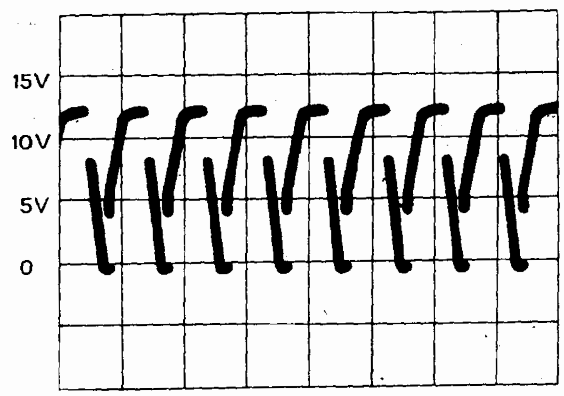


Fig. 149. Interruption of stator winding

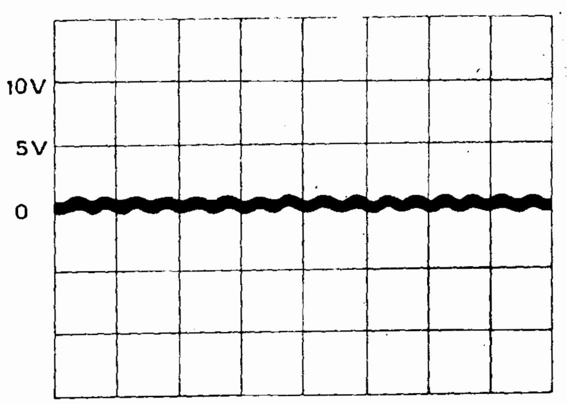


Fig. 150. Interruption of rotor winding

6.1.7.2. Fault Localisation

Fault	Possible Cause	Remedy
Part I		
Charging control light lights - ignition switch switched off - engine stopped	ignition switch defective	replace ignition switch
	cable to control light is short-circuited with positive potential	remove the short circuit
Part II		
Charging control light fails to light - ignition switch switched on - engine stopped	charging control light defective	replace electric bulb or lighting fitting
	cable 61 to regulator interrupted	replace cable by a new one
	ground of regulator and cable DF interrupted	replace cable by a new one
	rectifier defective (checking acc. to Section 6.1.10.1.)	replace rectifier
Part III		
Charging control light emits dimmed light - ignition switch switched on - engine stopped	corrosion in holder of charging control lighting fitting	clean or replace the holder
	cable DF from regulator to three-phase dynamo interrupted	replace cable by a new one
	rotor defective (checking acc. to Section 6.1.10.3.)	replace rotor
Part IV (loads switched off)		
Charging control light lights - ignition switch switched on - engine runs	damaged cables and connections between 61 regul. and 61 rectifier, D+ regulator and D+ rectifier, 51 regulator and battery	repair or replace the damaged parts
	The voltage measured between D+ regulator and ground is greater than that between 51 regulator and ground ($\Delta U > 0.2$ V)	replace the regulator
	regulator contacts between DF and 61 of the regulator insulated from each other	replace the regulator
	with the battery disconnected and the plugged connections withdrawn, perform a test between DF and 61 at the regulator by means of a resistance measuring bridge ($R > 0.5$ ohm)	
	rectifier defective (check according to Section 6.1.10.1.)	replace the rectifier
	cable DF between regulator and three-phase dynamo interrupted	renew the cable or the connections involved
	damaged carbon brushes or carbon brush connections	replace the damaged parts by new ones
	rotor defective (check according to Section 6.1.10.3.)	replace the rotor
	Cables U/V/W between stator and rectifier and/or ground connection damaged	replace the damaged parts by new ones
	magnetic shunt of stator (check according to Section 6.1.10.2.)	replace the stator
	shorted turns of stator (check according to Section 6.1.10.2.)	replace the stator

6.1.8. Demounting from the Vehicle

6.1.8.1. Demounting the Three-phase Dynamo

NOTICE:
Before demounting, disconnect the battery from the electrical system!

All plugged connections (U, V, W, DF, 61, D-) must be removed from the three-phase dynamo.

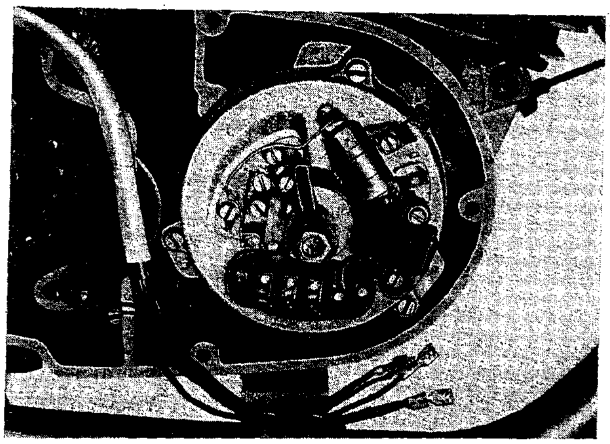


Fig. 151. Withdrawing the cables from the three-phase dynamo

After loosening the two fastening screws, remove the carbon-brush holders.

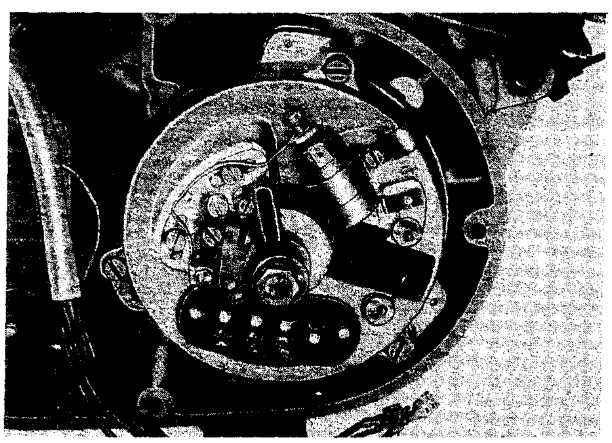


Fig. 152. Carbon-brush holders demounted

After loosening the three fastening screws, remove the stator with retaining cap.

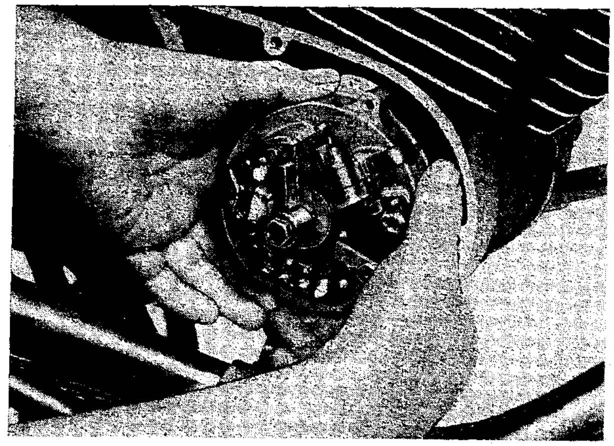


Fig. 153. Removing the retaining cap

Remove the rotor screw together with the cam. Separate the rotor from the crankshaft by means of the pulling device (pulling screw M 10 x 45 TGL 0-933-8.8).
In demounting take special care because the slip rings may easily be damaged. The removed parts must be protected from dirt, moisture and mechanical damage.

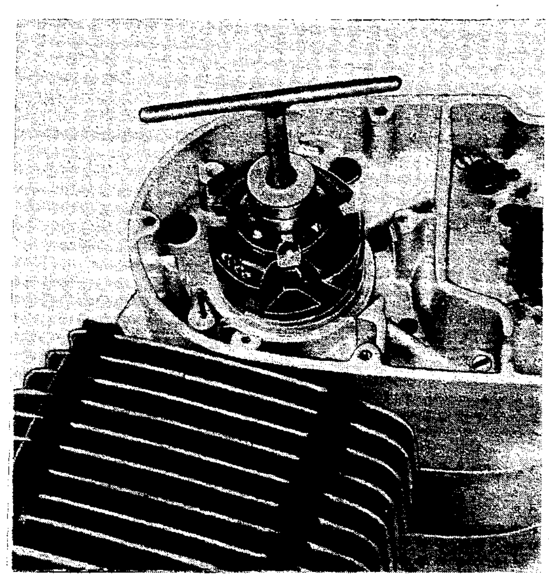


Fig. 154. Pulling off the rotor

6.1.8.2. Demounting the Rectifier

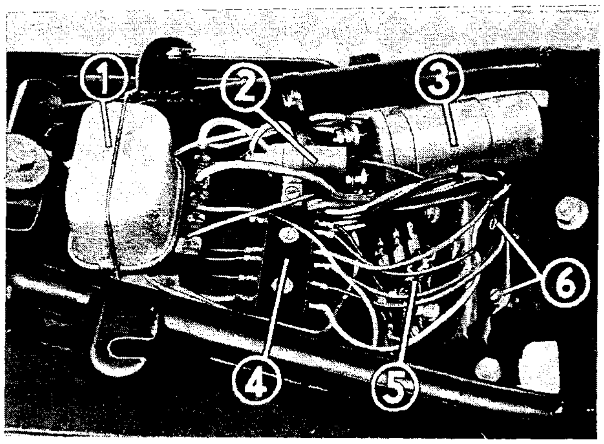


Fig. 155. Internal electrical equipment

(1) Regulator
(2) Capacitor 2.5 µF, 50 V
(3) Ignition coil
(4) Line connectors
(5) Rectifier
(6) Fastening screws

NOTICE:

Before demounting, disconnect the battery from the electrical system!

Remove the plugged connections U/V/W, 61, D+ and D- . For the later assembling operations, it is advisable to mark the cables D+ and D- and 61 for identification because exchanging by mistake of these connections will lead to the destruction of the diodes of the rectifier.

The connections U/V/M between three-phase dynamo and rectifier may be exchanged, damage will not be caused.

After loosening the fastening screws (6), the rectifier can be removed.

6.1.9. Demounting the Three-phase Dynamo

6.1.9.1. Stator with Retaining Cap

Carbon-brush holder (9, Fig. 156)

Loosen the plugged connections of the carbon brush. Remove the fastening screws. Pull off the holding clamp (10, Fig. 156). Hold the carbon brushes (8, Fig. 156) during this operation to prevent them from jumping out. Check carbon brushes and compression springs for wear.

Stator (6, Fig. 156)
Remove the soldered joint of the stator winding U/V/W.
Loosen the holding angle (5, Fig. 156). With this, the stator as complete component can be removed from the retaining cap (7, Fig. 156).

Rotor (4, Fig. 156)

The rotor is not intended for repairs. Replacement of the slip ring body must take place in special regenerating workshops.

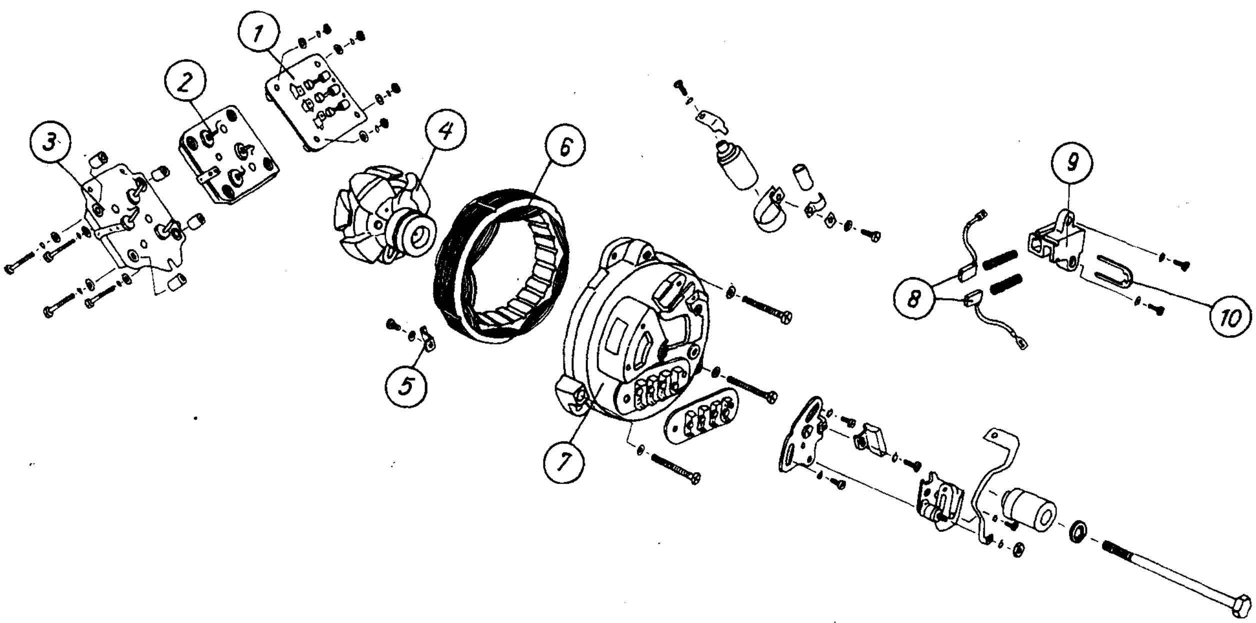


Fig. 156. Exploded view of the three-phase dynamo

(1) Insulating plate with excitation diodes
(2) Diode plate - positive
(3) Diode plate - negative
(4) Rotor
(5) Holding angle
(6) Stator
(7) Retaining cap
(8) Carbon brushes
(9) Carbon-brush holder
(10) Holding clamp

6.1.9.2. Rectifier

Loosen the four M4 fastening screws and unsolder the rectifier flexible wires from the plugged lugs U/V/W.

The three components can be tested separately (see Section 6.1.10.1.).

For pressing out defective positive or negative diodes, use a suitable mandrel (Fig. 157).

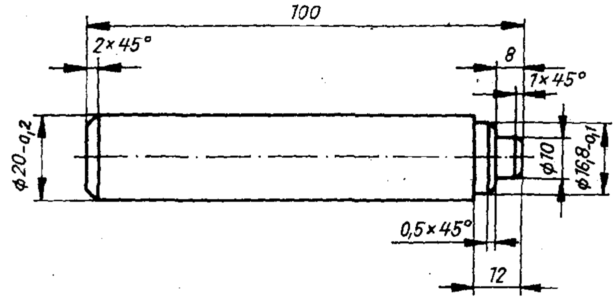


Fig. 157. Pressing-out mandrel
Round steel 22 TGL 11 163
St 50 K TGL 0-1652

For pressing new rectifiers in place, a pressing-in punch must be used (Fig. 158).

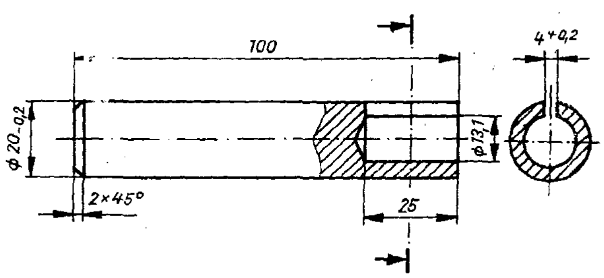


Fig. 158. Pressing-in mandrel
Round steel 22 TGL 11 163
St 50 K TGL 0-1652

A maximum pressing force of 4,000 N (400 kp) is permissible for pressing in. Care must be taken that the punch exactly contacts the diode edge.

For the use of semiconductor diodes, the instructions of the manufacturer must be observed.

6.1.10. Checking the Components

6.1.10.1. Checking the Rectifier

The rectifier diodes are tested by means of a continuity tester.

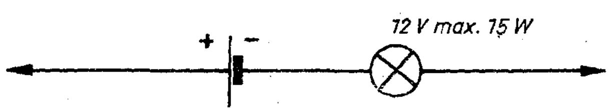


Fig. 159. Principle of diode testing

The measuring tips are applied to the anode and cathode connections of the diodes. When the positive measuring tip is applied to the anode and the test lamp lights, then the diode is serviceable.

When the lamp fails to light or when the test lamp lights while the positive pole is applied to the cathode, the diode is faulty and it must be replaced.

In the positive diode plate (D+), the cathodes are at the cooling plate and in the negative diode plate (D-) the anodes.

The excitation diodes are with their cathode applied to connection 61.

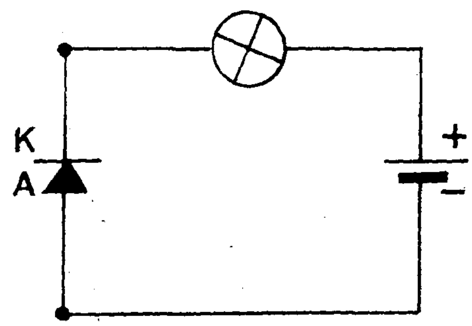


Fig. 160. Diode is in order

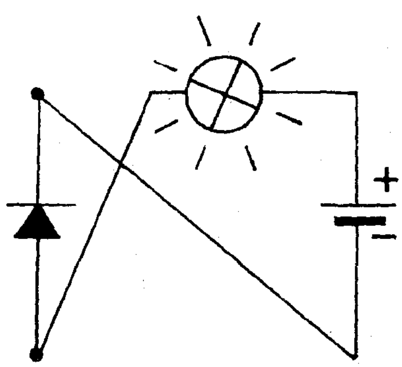


Fig. 161. Check-test - diode is in order

6.1.10.2. Testing the Stator

Testing the stator winding for shorted turns:

A resistance of about 0.32 ohm should be measured between the phases (U/V/W, V/W).

Testing the stator for magnetic shunt:

Between the stator sheet pack and the winding ends of the stator, the latter is tested for magnetic shunt by connecting a test lamp and applying a test voltage of 24 V a.c. All cables U/V/W must be disconnected from the stator. When the lamp lights up, the stator is defective and must be replaced by a new one.

6.1.10.3. Testing the Rotor

Testing the rotor winding:

Measure the resistance by means of a resistance measuring bridge.
It should be about 4.2 ± 0.3 ohm.
After removal from the vehicle, measurement is taken at the slip rings.

The test tips are slightly applied to the slip rings in order to avoid damage to the graphite slip ring.

6.1.10.4. Checking the Length of the Carbon Brush

Demounting according to Section 6.1.9.1.
When the carbon-brush lengths falls below 9 mm, a new carbon brush must be fitted.

6.1.11. Assembling Instructions

Joints to be soldered must be made with acid-free solder and protected against corrosion by means of electro-insulating protective varnish (can be soldered).

The protection should also cover newly soldered excitation diodes. This is effected by dipping the whole rectifier. The plugged connections must be covered and, after dipping, remains of varnish must be removed from them.

Stator

When mounting the stator in the retaining cap take care that the groove in the stator coincides with the groove in the retaining cap.

Permissible torque for tightening the rotor fastening screw M 7/5.8 = 20 ± 2 Nm (2 ± 0.2 kpm)

Permissible torque for tightening the stator fastening screw 5/5.8 = 4 ± 0.5 Nm (0.4 ± 0.05 kpm).

It is advisable to mount the carbon-brush holder after mounting the retaining cap.

NOTICE:

Before connecting the battery, check the lines. When the connections D+, D-, 61, DF are exchanged by mistake, there is the risk of destroying the semiconductor elements and additional components. Take care that the polarity of the battery (negative pole to ground) is correct when connecting.

Information for adjusting the ignition and the application of the lubricating felt pad is given in special documents for the vehicle.

6.1.12. Important Information

When charging batteries with mains-fed charging equipment, disconnect the battery from the electrical system of the vehicle.

When performing welding operations in the vehicle, take care that + (positive)lines of the electrical system of the vehicle do not get into contact with the welding electrode. The battery must be disconnected.

When the engine is running, connections between three-phase dynamo, rectifier and regulator must not be interrupted because this will lead to damage to the electrical system.

For checking operations at the three-phase dynamo and rectifier, the measuring instruments must be connected with safe connections.

When operating the three-phase dynamo without battery, a capacitor, 2.5 µF, 50 V, must be connected between d+ and d- of the rectifier (in the ETZ 250, it is present close by the line connector at the intake silencer as standard equipment).

6.2. Regulator

The three-phase dynamo is a temperature-compensated, positive-regulating regulator with break characteristic. This single-system regulator, 14 V, 15 A, operates with voltage regulation and current regulation.The current regulation is rated for a maximum current of 15 A. The regulating (series) resistor (connection side) and a balancing resistance are incorporated in the regulator.

6.2.1. Mounting

In order to ensure proper operation of the regulator it must be mounted so that it is not exposed to vibrations.
This has been realised in the ETZ 250 fully because the regulator cut-out is supended by means of a foamed-plastic pocket and a rubber stopper elastically.

When mounting, take care to see to it that the regulator cut-out is properly inserted in the holder provided for this purpose.

6.2.2. Maintenance

Maintenance of the regulator is generally restricted to keeping the connections clean. When the headlamp light is too dim, when there are starting difficulties and the like, do not always blame the regulator for the fault and on no account make any unauthorised interventions but first check the lines and their connectors for proper fit and corrosion.
See to it that the regulator is not touched by parts such as a spare inner tube and the like placed under the dual seat.

6.2.3. Adjustment

Before the electrical adjustment, a mechanical pre-setting or a correction of the mechanical setting must be effected in any case. This facilitates the electrical adjustment and ensures the observance of the required voltage/current characteristic.

An electrical adjustment of the regulator IN THE VEHICLE is a makeshift and should be avoided in the interest of an optimum performance of the function of the current supply system.

For adjusting the regulator cutout, it is mounted on a test stand controllable within a speed range from 0 to 7,000 rpm together with a dynamo of the required type.

In order to avoid errors in the adjustment, the voltage must always be started from the speed "zero" of the dynamo. The voltage is measured between the terminals D+ and D- of the regulator. The measuring instrument to be used should be of quality 1.5.

To be set:

- regulated voltage U_{3A}

Voltage which will be regulated over the entire speed range when the dynamo is loaded with 3 A. The voltage must be within the specified tolerance range. Short voltage peaks beyond the tolerance range at the beginning of the lower-position and upper-position regulation should not be confused with wrong adjustment.

The regulated voltage may differ for about + 0.2 to - 0.1 V (voltage jump) between the end of the lower-position regulation and the beginning of the upper-position regulation.

The voltage jump should not be adjusted too negative otherwise the regulator armature will chatter, i.e. continuously move between upper and lower position.

- maximum load voltage U_{HL}

Voltage which is regulated at a speed of more than 3,800 rpm when the dynamo is loaded with 15 A.

- release current I_{AS}

At this current, the current regulation starts operating.

Electrical setting values

The following values apply to a regulator temperature of 20 °C ± 5 °C.

regulated voltage:	13.8 V to 14.6 V
maximum load voltage:	13.0 V to 13.5 V
release current:	11.5 A to 14.0 A

NOTICE:

To change the regulated voltage and the release current, only carefully bend the spring holder. Do not bend the contact tongue!

6.2.4. Damages and their Causes

The most essential things have already been said in Section 6.1.

In addition, the following must be observed:

The improper fitting of the protective cap of the regulator cutout leads to accidental ground when the cap gets into contact with the core or with the contact angle of the regulator cutout. Before opening the regulater, remove the fuses. The lugs at the side of the cap must be correctly inserted into the recess provided for this purpose in the regulator base. The wire bow must tightly fit on the cap.

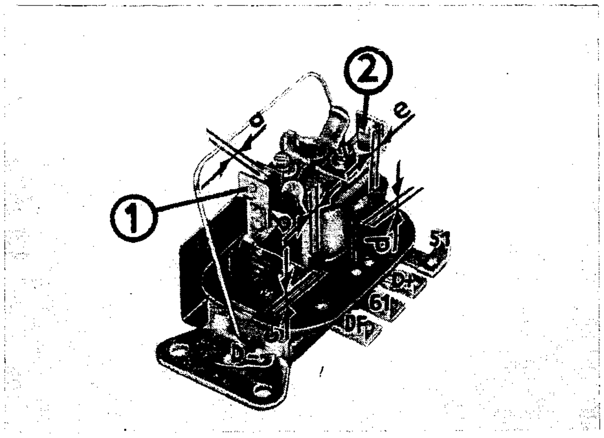


Fig. 162. Mechanical regulator adjustment

a at least 0.3 mm
b 0.8 to 1.1 mm
c 0.5 ± 0.1 mm
d 0.5 ± 0.1 mm
e 1.4 to 1.5 mm
(1) contacts of the voltage regulator
(2) contacts of the current regulator (current limiting switch)

6.3. Battery

A flat lead battery with a rated voltage of 12 V and a rated capacity of 9 Ah is used.

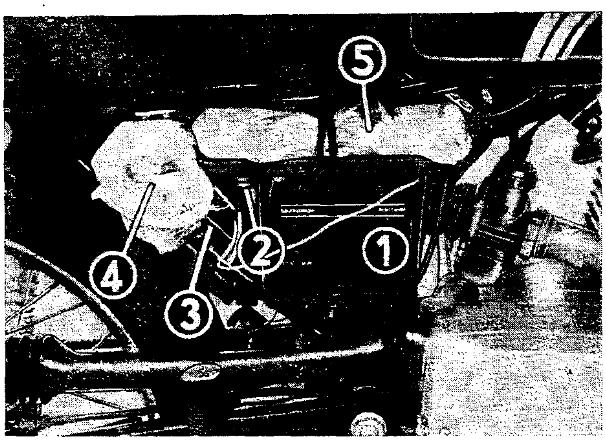


Fig. 163. Battery arrangement

(1) Battery
(2) Flasher unit
(3) Fuse box
(4) Spare electric bulbs
(5) Tool kit

When putting into operation, accumulator sulphuric acid (below called electrolyte) having a density of 1.28 ± 0.01 g/cm3 (in the tropics 1.22 ± 0.01 g/cm3) measured at 20 ± 2 °C, is filled into the battery.
All cells of the battery must be filled up to 5 mm on top of the separators or up to the given acid level mark. When filling, the temperature of the electrolyte should 25 °C not exceed.

After about 2 to 3 hours, the plates and separators have soaked and the electrolyte level is dropped.
Once more, electrolyte of the same density and temperature must be topped up to the upper edge of the separator. Subsequently, the battery is charged with direct current of 0.5 A.
During the charging, the holes of the battery must be open.
Charging must be continued until all cells vividly and uniformly evolve gas and the voltage reaches 2.5 to 2.7 V per cell.

For 2 to 3 measurements at intervals of one hour, the density of the electrolyte (1.28 ± 0.01 g/cm3) and the cell voltage must remain constant. During charging, the temperature of the electrolyte must not exceed 50 °C. At the end of the charging process, the level of the electrolyte must again be measured.

Mounting the battery

Before mounting the battery in the vehicle, the two battery cables must be connected to the battery (red cable to the positive pole - brown cable to the negative pole) and preserved with grease for battery terminals or acid-free vaseline. After fitting the protective cap, the battery can be mounted and the two battery cables can be connected to the fuse box.

HERE, AGAIN OBSERVE: connect

red cable to red cable,
brown cable to brown cable !

The vent hose must be installed in such a way that acid which may emerge from it cannot get into contact with varnish or metal parts.

Maintenance of the battery

The average service life of the battery is about 2 years. Due to a good or bad maintenance, this period can be extended or shortened. The maintenance is mainly limited to the terminals which have to be kept clean - they must be provided with a thin film of grease for battery terminals - and the regular control of the acid level (in the cold season every 4 weeks, in the warm season every 2 weeks). When greasing the terminals, care must be taken that no grease gets into the cells.

When the acid level has dropped below the required height, top up with distilled water only.

If acid is spilled from the battery, the density of the amount to be filled in must be so selected that the density of the whole amount of acid in the battery will be 1.28 ± 0.01 g/cm3 when the battery is charged.
When not used or when the distance covered every day is less than 50 km, the battery must be charged every month with 1 A.

6.4. Ignition

6.4.1. Ignition Coil

The ignition coil can be compared with a transformer which converts a low voltage into a high one. Since, however, only an alternating voltage can be transformed while the electrical system of the vehicle is fed with direct voltage, a continuous voltage change must be caused; this is performed by the contact breaker together with the capacitor.

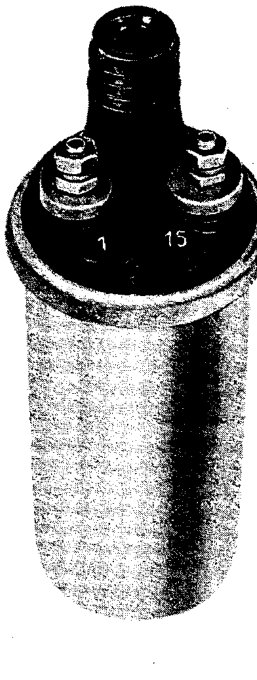


Fig. 164. Ignition coil

The normal voltage of 12 V is transformed to the ignition voltage of about 12,000 V. The two connecting bolts of the ignition coil are marked.

Terminal 1 is connected with the contact breaker and terminal 15 with the terminal 15/54 of the ignition lock.

NOTICE:
When the engine is stationary, the ignition switched on and the contact breaker closed, the ignition coil will be subject to a current which will heat the ignition coil in a prolonged period of time. At the same time, the insulating material will be destroyed. The ignition coil will break down and, thus, become useless.

6.4.2. Contact Breaker

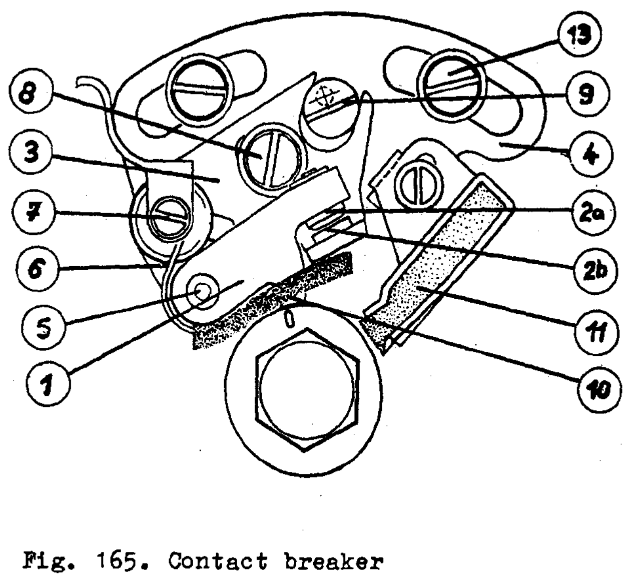


Fig. 165. Contact breaker

The design of the contact breaker is shown in Fig. 165.
The adjusting plate (4) serves as carrier of plate (3) and the felt pad (11) and also for adjusting the firing point.
To the plate (3) with the fixed contact (2 b), the bearing bolt (5) is fastened on which the lever (1) is pivoted.

The contact (2 a) riveted to the right end of the lever (1) is pressed on the fixed contact (2 b) by the return spring (6) which also serves as current conductor and is supported at one spring end by the connecting screw (7). The contact breaker points gap can be adjusted precisely by the accentric screw (9) after loosening the fastening screw (8). The felt pad (11) which is slightly soaked with the special oil "Unterbröl" should be approached to the cam just far enough that the lobe is touched.
If this is not observed and the felt is moved closer to the cam, the oil is squeezed out of the felt and lubrication of the cam is not ensured. Result: The nose shows great wear - the contact breaker points gap and the set advanced ignition will change.

The felt (10) serves for collecting the excessive oil and must not be oiled in addition. A heavily contaminated felt must be replaced.

6.4.3. Ignition Timing

- ADJUSTING THE BREAKER POINTS GAP

Before adjusting, it is necessary to subject the contact breaker to a check. For this purpose, the contacts are removed (see Fig. 165).
The screw (7) is unscrewed, the contact rail is pressed upward, the fastening screw (8) removed and the breaker base plate taken off. When burns can be found on the contact surfaces, they can be removed by means of a fine emery file. In case of heavy burning of the contacts, the breaker base plate with contact breaker must be replaced.

When mounting take care that the adjusting plate (4) is clean and free from oil as well as the complete breaker set. When this is neglected, erratic ignition and starting difficulties will occur. Old lubricant remains must be removed from the bearing bolt (5) and the breaker hammer must be mounted in a slightly oiled (breaker oil) condition. The breaker points must be set in such a way that they are parallel to each other.

When adjusting the breaker gap, the crankshaft is turned until the nose of the breaker lever is on the lobe of the cam. The fastening screw (8) is loosened and, by means of the eccentric screw (9), the breaker points gap is adjusted in such a way that the feeler gauge can just be drawn through the contacts.
Tighten the fastening screw (8) and once more check the braker points gap by means of the feeler gauge.
The contact breaker gap set must remain constant during the whole opening angle while the cranshaft is turned, on no account should the gap increase, otherwise a cam stroke will be involved which leads to erratic ignition at higher rotational speeds.

- ADJUSTING THE FIRING POINT

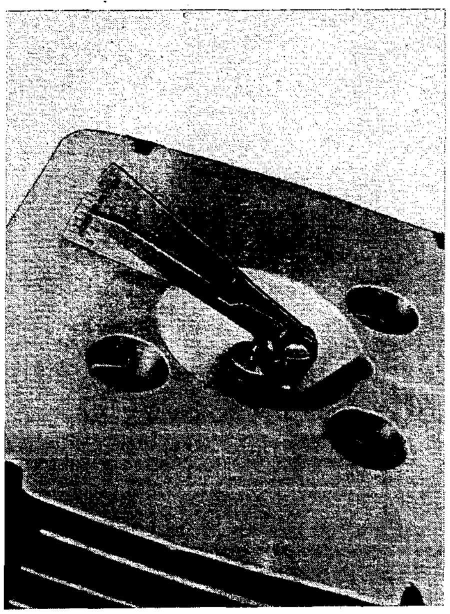


Fig. 166. Ignition timing gauge 29-50.801 screwed in place

($3.0_{-0.5}$ mm before T.D.C. or 22° 15' - 2° crank angle)

The adjustment is made by means of the ignition timing gauge 29-50.801 and a test lamp.
The ignition timing gauge is crewed into the sparking-plug thread, and by turning the crankshaft clockwise the scale of the timing gauge is automatically set to the top dead centre (T.D.C.).

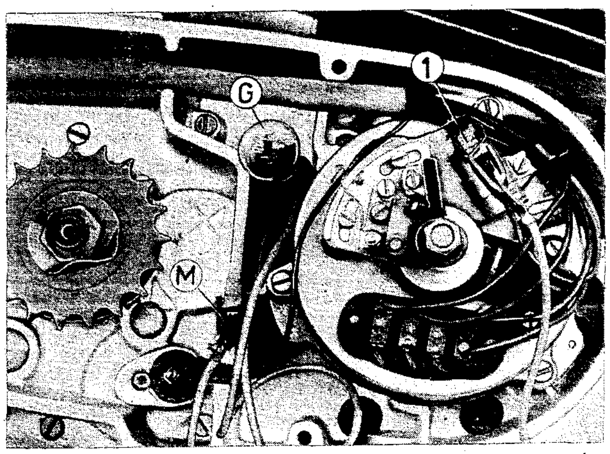


Fig. 167. Test lamp connected by clamping

The pointer of the timing gauge is at "O" of the scale when the piston is in T.D.C. The test lamp with an electric bulb (G) of 12 V and max. 2 watt is with its positive side (1) clamped to the current bar (from contact breaker to capacitor) and with its negative side (M) to the engine casing or the cylinder.
When continuing to turn the crankshaft through about 340 degrees in clockwise direction, the pointer of the timing gauge will arrive at firing point 3 (mm) of the scale via the scale values 5 to 4 (mm). When at this point the test lamp starts lighting (battery connected to the electrical system of the vehicle and ignition switched on), the firing poit is correctly set.

When the test lamp lights up too early (e. g. between the scale values 4 and 3), the contact breaker opens too early and the adjusting plate (4) must be turned to the right in the sense of rotation after loosening the fastening screws (13). When the test lamp lights up after the scale value 3 (e.g. at scale value 2), then the contact breaker opens too late and the adjusting plate (4) must be displaced to the left opposite to the sense of rotation (see also Fig. 165).

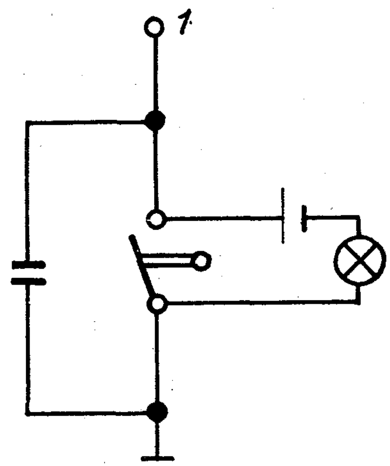


Fig. 168. Checking the firing point with a current source outside the vehicle

After any adjustment of the adjusting plate (4), the contact breaker points gap must be checked and adjusted, if required. Measurement of the firing point must be repeated until the test lamp lights up at the scale value 3 x $_{-0.5}$ while the piston moves up.

When an outside current source (not the electrical system of the vehicle) is used for adjusting the firing point, the test lamp will go out when the contact breaker points open.

NOTICE:
On no account should the contact breaker open earlier than $3.0_{-0.5}$ mm before T.D.C. otherwise the combustion in the engine will be finished too early and the combustion pressure presses on the piston already before the T.D.C. which means overheating, power drop and high wear on the engine.

6.4.4. Sparking-plug

In essence, the sparking-plug consists of three parts. These are the insulating body, the central electrode and the steel casing with ground electrode. The spark appears between central electrode and ground electrode and ignites the fuel-air mixture.

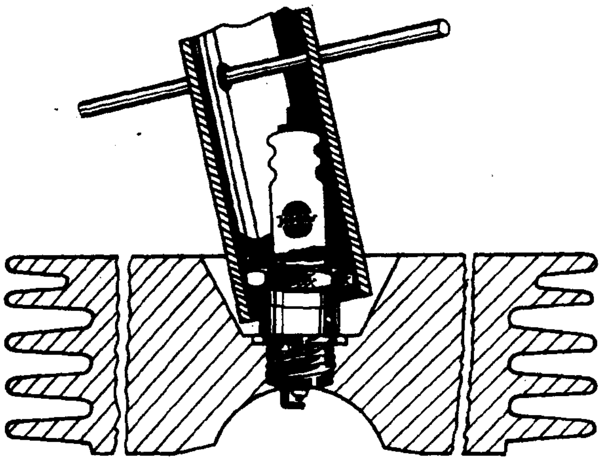


Fig. 169. Improper screwing in and out of the sparking-plug

The insulating body must have a very high dielectric strength. In order to ensure this dielectric strength at any time, the plug must be treated with every care.
Due to improper handling, (strike, impact) almost invisible hair cracks may occur which render the plug useless.

The service life of a sparking-plug used in two-stroke engines is about 10,000 km of road operation. After this performance it is generally advisable to REPLACE THE PLUG BY A NEW ONE.

The ETZ 250 is provided with a M 14/260 sparking-plug. It is advisable to use always such a plug (observe the calorific value).
A lower calorific value in winter or a higher one in summer will not give any advantage but rather disadvantages; but this may be required in extreme climatic zones.

The correct seat of the plug is also of particular importance. The thread of the plug must be flush with the thread in the cylinder head.
When the plug projects too far into the chamber of combustion (no or a compressed packing ring uder the plug) or when the plug is not far enough screwed in (two packing rings under the plug), heat accumulation or overheating will occur.

Maintenance requirements of the plug are relatively small. The electrode gap must be checked every 2,500 km and the plug electrodes must be cleaned.

When changing the plugs, an exactly fitting sparking-plug spanner must be used in order to avoid breakage of the insulating body (Fig. 169. In any case, pay attention to the sparking-plug appearance. It enables to draw conclusions about the mode of operation of the engine, the formation of the petroil-air mixture, the fuel used and the suitability of the plug for the engine after a prolonged period of use of the plug.

The correct SPARKING-PLUG APPEARANCE:

Face of the sparking-plug thread black and the tip of the insulating body with ground electrode grey-yellow to fawn.

6.4.5. Ignition Line Connector (Sparking-plug Connector)

The ignition line connector establishes the connection between the sparking-plug and the ignition cable and to screen the electrical field of the sparking-plug to the outside.
In order to screen the sparking-plug so that interference is completely suppressed, take care that the sheet-metal shell attached to the connector is properly seated on the hexagon part of the sparking-plug.
On no account should the sheet-metal shell be removed because this leads to interferences with v.h.f. and television reception.

Carefully handle not only the plug but also the ignition line connector. Hair cracks in the insulating body which lead to tracking render it useless. Erratic ignition occurs when the plug connector is moist, dirty or oiled up in its interior.

6.4.6. Troubles in the Ignition System

Due to wear and ageing of the various devices, troubles may be caused in the ignition system.
Below, a few of the main causes and their effects will be described:

1. Cam track poorly lubricated
   Wear of the nose of the contact breaker, breaker gap too small or none at all =

   starting difficulties,
   irregular running,
   decrease in power

2. Capacitor breakdown,
   high wear rate on contacts

   erratic ignition at higher rotational speeds

3. Setting of the breaker gap in case of pitting of the contacts,
   the actual gap is too large =
   erratic ignition at higher rotational speeds,
   weak spark,
   decrease in power

4. Cranshaft bearings worn

   excessive eccentricity of the crankshaft and, hence, of the cam,
   carbon brushes and contact breaker "jump" = erratic ignition

5. Low pressure of the contact spring (contact breaker)
   breaker lever has no exact guide on the cam track =

   erratic ignition at higher rotational speeds

Ignition line connector:

1. Dust and water is between insulating body of the sparking-plug and the compression moulding of the connector =

   starting difficulties,
   erratic ignition

2. Due to improper handling, the insulating body is cracked (hair cracks)

   tracking to ground =

   starting difficulties,
   weak spark,
   decrease in power

Lines:

1. Defective insulation of the high-voltage line (ignition cable) sparkover to ground (cylinder head) =

   starting difficulties especially in wet weather,
   erratic ignition at high rotational speeds

2. Broken lines,
   short-circuit =

   blown fuse

3. Flat plugged connections heavily corroded, very high contact resistance =

   the voltage applied to the devices is too low.

6.5. Lighting and Signalling System

6.5.1. Headlamp

The headlamp is opened by loosening the fillister-head screw and removing the front part of the headlamp housing. The front part consists of the chromium-plated front ring, the reflector with diffusing screen, the tiwn-filament bulb and the parking lamp and their holders.

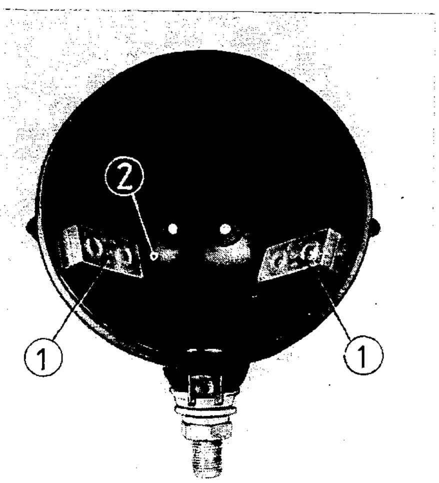


Fig. 170. Headlamp housing

In the headlamp housing, there are two line connectors (1) and one ground connection screw (2) which is used for all ground cables passed through the headlamp.

NOTICE:

As line connector only that one may be used which is shown in Fig. 171 in open position!

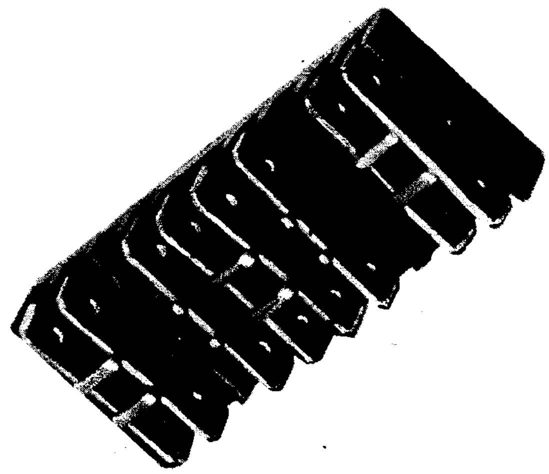


Fig. 171. Line connector for headlamp and for the internal electrical equipment

When replacing a twin-filament bulb, observe the following:

The clamping member (thermosetting plastic part), which establishes the electrical connection with the lamp, must be withdrawn in straight direction - it must not be tilted - otherwise the contact lugs will be distorted. As a consequence, the current flow may be interrupted.

The cables which lead to the terminals 31, 56a, 56b, need not be disconnected. It is advisable, however, to check them that they fit tightly. Only the cable 58 (parking light) must be loosened.

The holder (1) for the twin-filament bulb and the parking lamp is loosened from the upper sheet-metal nose of the reflector by lifting the retaining spring (H). Then the twin-filament bulb can be taken from the reflector. The glass bulb of the lamp should not be gripped by the bare hand. Even clean fingers leave traces of grease!

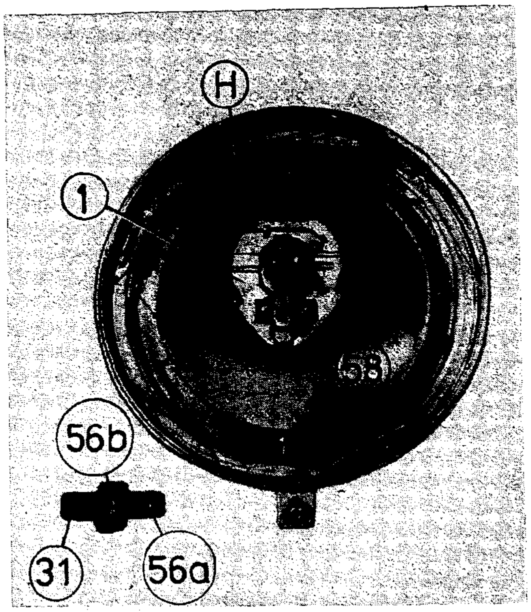


Fig. 172. Front part of the headlamp with lamp holder

When fitting take care that the nose at the lamp cap engages with the recess in the reflector.

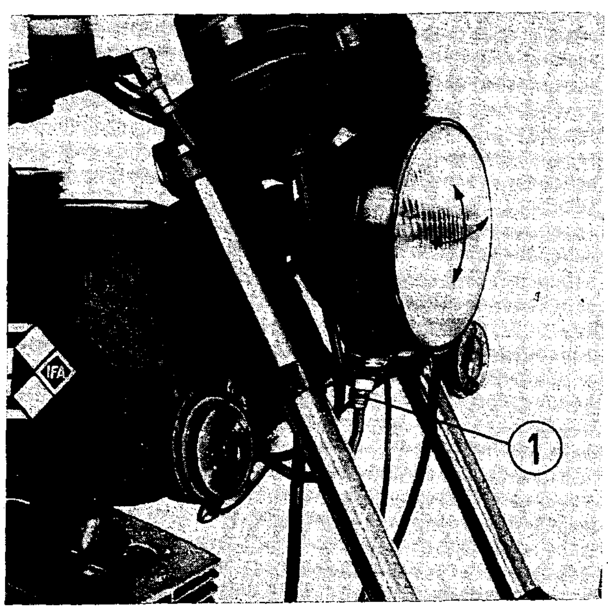


Fig. 173. Adjustment of the headlamp

When the carriageway illumination is insufficient, the points of contact in the leads to the twin-filament bulb must be checked and carefully cleaned, if required.

DIRTY CONTACTS CAUSE A CONSIDERABLE VOLTAGE DROP!

In older vehicles, the reflector may have become dull. In the interest of your safety it is necessary to replace it by a new one. The diffusing screen and the reflector are glued together, they cannot be replaced separately.

An important task is the adjustment of the headlamp. It is necessary for your own safety and for the safety of other road users.

The headlamp can be adjusted after loosening the fastening nut (1).

The passing beam of the headlamp is adjusted according to the scheme given in Fig. 174.

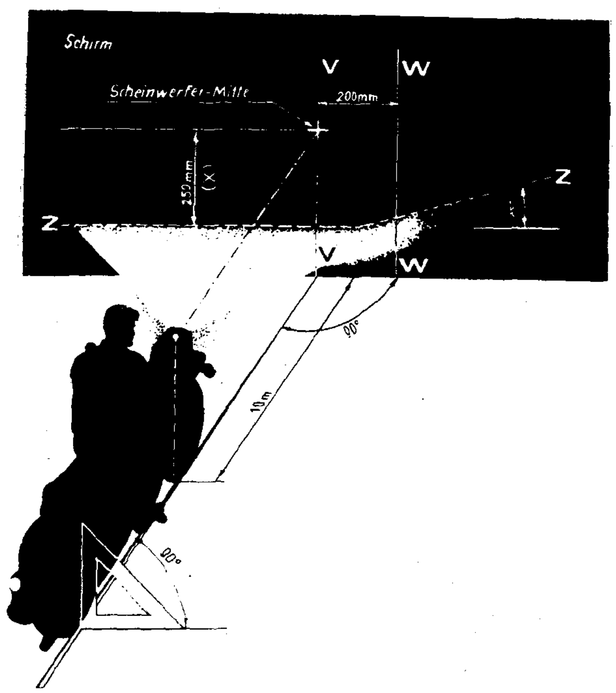


Fig. 174. Headlamp adjusting scheme

The vehicle is placed according to the illustration and loaded according to the primary operating conditions. The suspension units are consequently set to "hard" or "soft".

The light/dark boundary must concide exactly with the Z-line, and the break must lie between the lines V-V and W-W. When the headlamp has been adjusted according to these instructions, the light-dark boundary will be at the correct level under all operating and load conditions.

6.5.2. Combined Stop-Tail-Number-plate Lighting Fitting

The combined stop-tail-number-plate lighting fitting is proved with ball lamps which are held in holders with bayonet catch as usual.

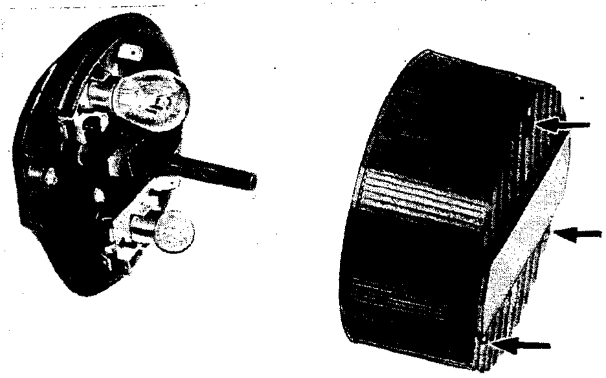


Fig. 175. Combined stop-tail-number-plate lighting fitting interior (partly cut up)

The bulbs and cable connections are accessible after unscrewing the fastening screws (arrow-heads) and the removal of the light emitting pane.

In the combined stop-tail and number-plate lighting fitting, everything also depends on tight non-corroded connections. In assembling, after fitting the packing, screw the light emitting pane in place in such a way that the lighting fitting is protected from moisture and that the light emitting pane does not break.

6.5.3. Ignition-light Switch

The ignition-light switch is the main switch of the electrical system.

It is used to switch the following (see Fig. 176 and Wiring Diagram, Fig. 184):

(0) All loads switched off, ignition key can be withdrawn

(1) Parking position at night (parking light), ignition key can be withdrawn

(2) Daytime operation (ignition switched on), ignition key cannot be withdrawn

(3) Ignition switched on, parking lamp lighting, ignition key cannot be withdrawn

(4) Night operation, ignition and main light switched on, ignition key cannot be withdrawn.

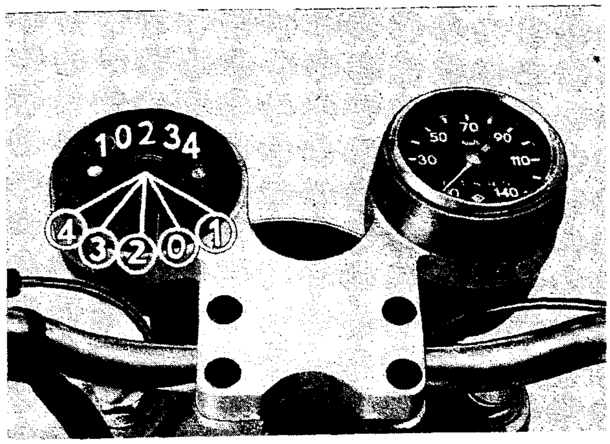


Fig. 176. Switch positions of the ignition-light switch

Demounting and mounting the ignition-light switch is illustrated in Fig. 177. In the deluxe model (A in Fig. 177), the instrument pod (1) must be unscrewed from the upper clamping head. Then, the covering cap (2) and the ignition-light switch will be accessible.

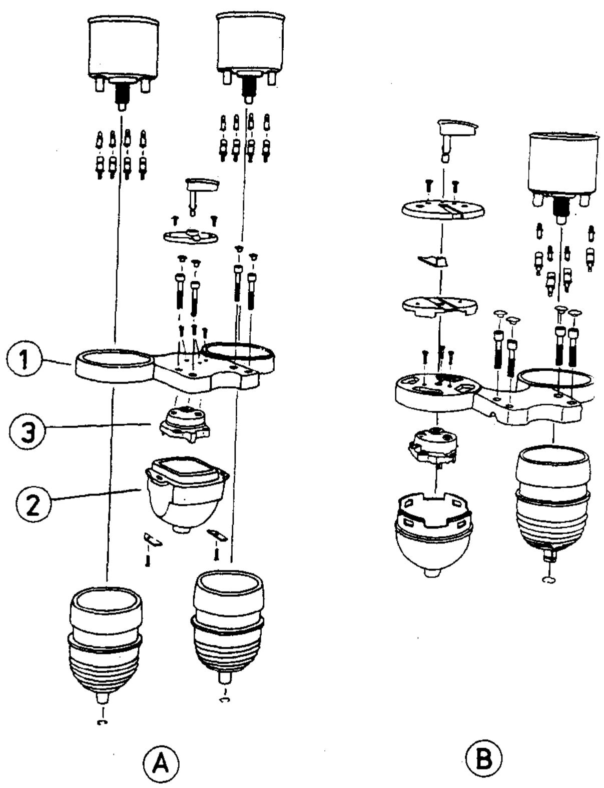


Fig. 177. Exploded view of instrument pod
(A) deluxe model
(B) standard design

In order to be in a position, to plug the cables on the correct lugs after replacing the ignition-light switch, the individual connections involved have been clearly identified in Fig. 178.

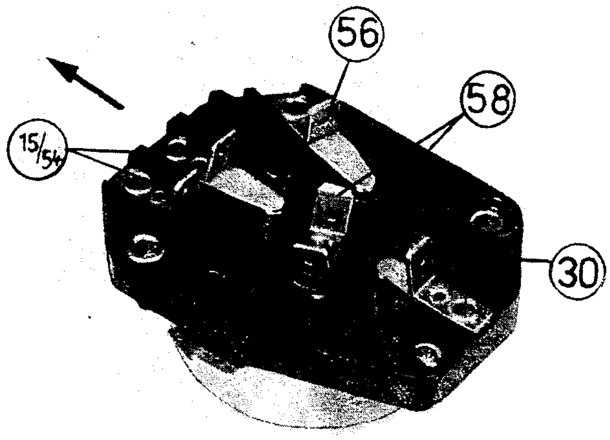


Fig. 178. Connections of the ignition-light switch

The ignition-light switch shown in Fig. 178 cannot be used for the older MZ-types because the former switch position (5) is no longer switched electrically. On the other hand, an ignition-light switch of older types can be used also for the ETZ 250.

MOUNTING HINT:

The arrow in Fig. 178 shows the mounting position of the ignition-light switch in travel direction, connections downward.

6.5.4. Switch Combination at Handle-Bars

The switch combination at the left-hand handle-bar comprises the following switches (Fig. 179):

(1) Dimmer switch
(2) Switch for direction indicator
  (L) Flashing-light left side
  (R) Flashing-light right side
(3) Switch for horn
(4) Switch for by-pass light signal

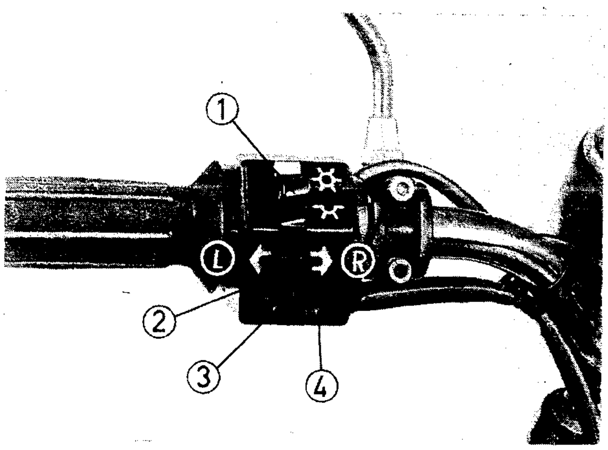


Fig. 179. Switch combination at handle-bars

The various switches are fastened in the enclosure by means of sheet-metal screws (switch for direction indication A and switch for horn B_1 and by-pass light signal B_2) or actuation slide and spring (dimmer switch C). The cables are soldered to the switches by the manufacturer).

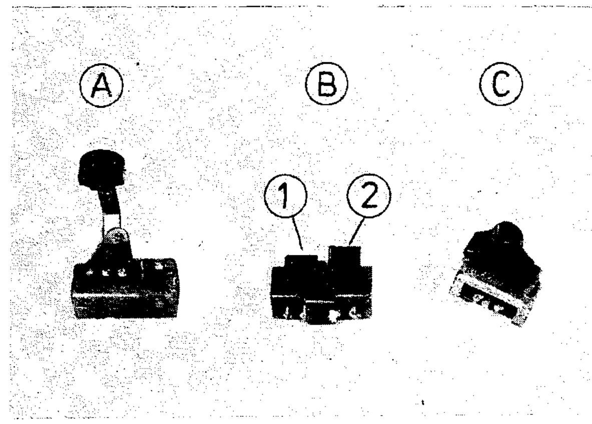


Fig. 180. Individual switches of the switch combination at the handle-bars

NOTICE:

The switch combination of the light motor-cycles Simson S 51 cannot be used for the ETZ 250 because the switches which are the same as that of MZ have different cables soldered on!

6.5.5. Stop-light Switch

In the motor-cycle design with disk brake, two stop-light switches are installed. The front drum brake can also be equipped with a stop-light switch which corresponds to the switch in the rear wheel hub.

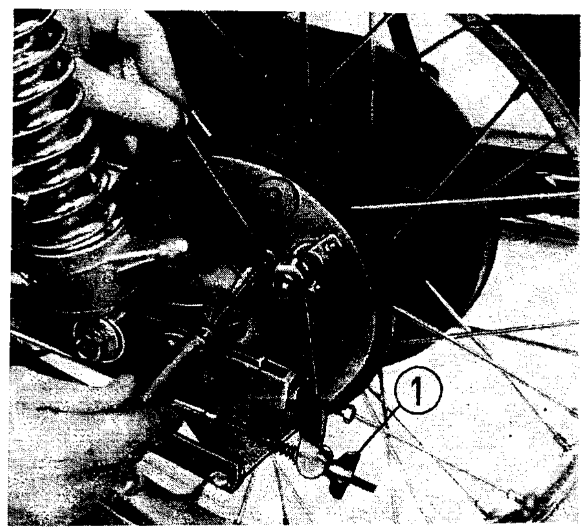


Fig. 181. Adjusting the rear wheel brake and stop-light switch

For adjusting the stop-light switch, loosen the plugged connection (2) and slacken back the check nut until the rear nut can be properly gripped by means of an open-ended spanner. This nut is slackened back for a quarter of a revolution.

Now, an assistant presses the brake pedal down until the brake shoes begin to rub on the brake drum while the rear wheel is turned. Retain the brake pedal in this position and turn the adjusting screw until the stop light flashes up.
For this work, the ignition must be switched on and the cable connected. Then tighten the two nuts. The rear nut must be tightened with every care because the insulating bush is made of plastic. At the same time retain the adjusting screw (3) by means of a screwdriver.
When the adjusting range is insufficient, the back rest must be demounted and the contact spring at the cam spindle must be realigned.

6.5.6. Flashing-light Direction Indicator System

The ETZ 250 is provided with a four-indicator flashing-light system equipped with 21-W ball lamps. When replacing the flashing lamps, only 21-watt lamps mustbe installed. Other lamps, e.g. such of 15 watt, change the specified flashing frequency of 90 ± 30 cycles/minute.

A tell-tale lamp (No. 4 in Fig. 185) is used for checking the direction indicating system. The two front flashing-light diffusing screens are provided with a larger rim (1) than the two rear ones. This rim is intended for checking the flashing-light system by the driver.

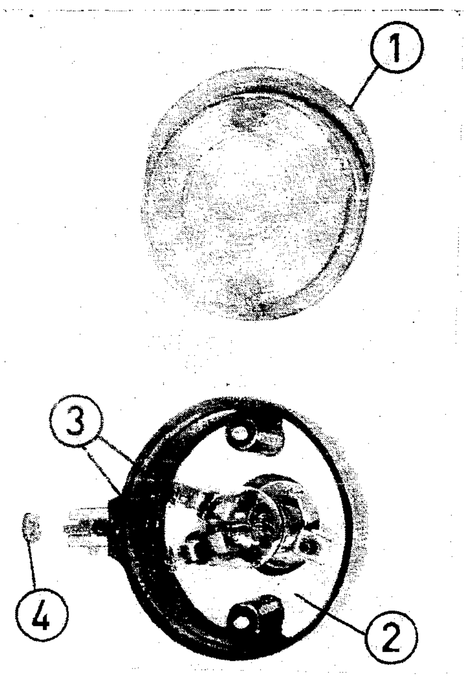


Fig. 182. Front flashing-light direction indicator
(1) Rim for checking the action of flashing
(2) Plastic reflector
(3) Terminals (4) Packing

The failure of one flashing-light direction indicator is indicated by an increased flashing frequency (> 150 periods/minute) of the front flashing-light indicators.
The whole flashing-light system is protected by a 4-A fuse (see Fig. 163).

The flasher unit is elastically suspended at the battery holding cover with the connections pointing downwards.

NOTICE:

The line from the ignition lock with positive potential is to be connected to terminal 49 and the line from the flasher switch with negative potential to the terminal 49a of the flasher unit.

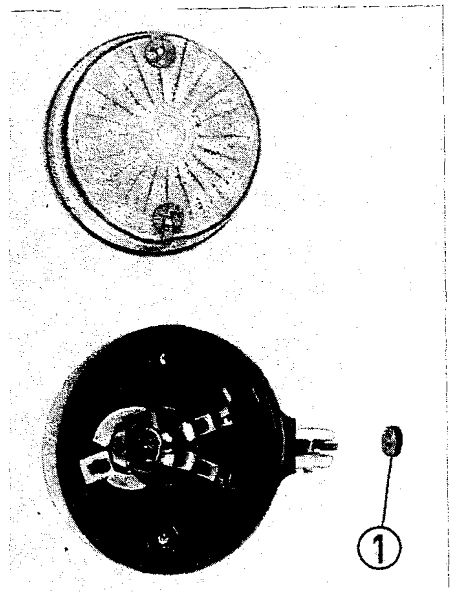


Fig. 183. Rear flashing-light direction indicator
(1) Packing

6.5.7. Horn

The electric horn is fastened to the frame under the fuel tank.
Before demounting the cylinder head or the cylinder, the signal horn must be unscrewed.

If, upon actuating the push button, the horn fails to emit the required volume of sound, then the leads, their connections and the push button must be checked for dirty contacts. If such are present, the voltage applied will be too low.

If this is not the cause, turn the adjusting screw at the horn slightly to the left or to the right until the sound has the desired loudness.

6.5.8. Circuit Diagram

The circuit diagram, Fig. 184, gives the required data on course of cables and cable colours for repairs at the loads and the electrical system.

The electrical wiring diagram is included in this Repair Manual in the form of a fold-out sheet.

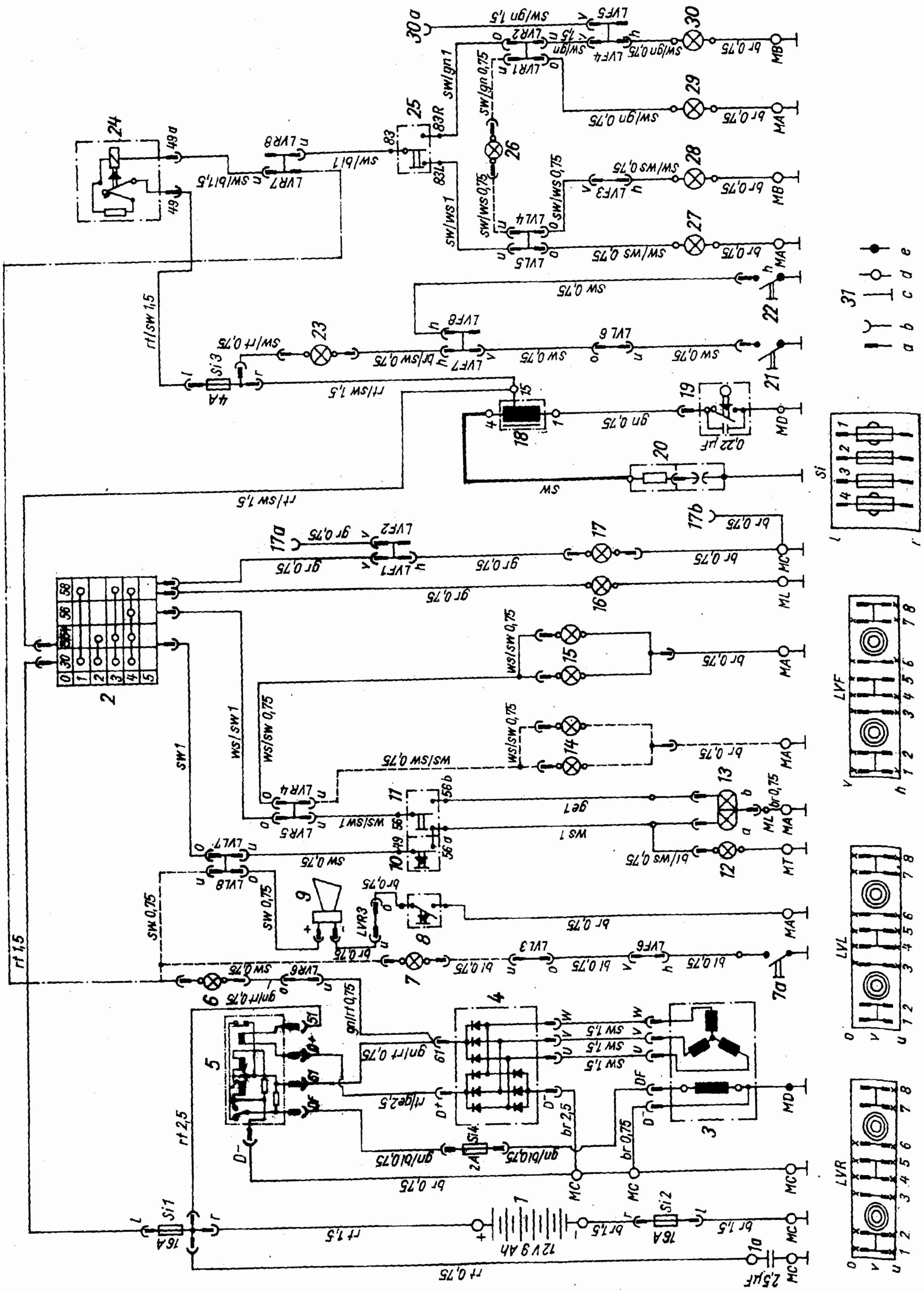


Fig. 184. Circuit diagram

Legend for Fig. 184, Circuit diagram

(1) Battery

(1a) Capacitor

(2) Ignition-light switch

(3) Dynamo

(4) Rectifier

(5) Regulator

(6) Charging control lamp (in standard design also for checking the direction indicators)

(7) Idling control light (only deluxe model)

(7a) Switch for idling control light

(8) Switch for horn (switch combination at handle-bars

(9) Horn

(10) Switch for by-pass light signal (switch combination at handle-bars)

(11) Dimmer switch (switch combination at handle-bars)

(12) Tell-tale light for high headlight beam

(13) Lamp for headlamp
a) high beam
b) passing beam

(14) Illumination for speedometer scale (only deluxe model)

(15) Illumination for tachometer scale

(16) Parking light (in headlamp)

(17) Tail light and number-plate illumination (in tail-stop and number-plate lighting fitting, bottom)

(17a) Socket outlet for side lamps (only for side-car operation)

(17b) Socket outlet for ground (only for side-car operation)

(18) Ignition coil

(19) Contact breaker of the ignition

(20) Sparking-plug with screened connector

(21) Stop light switch - front wheel brake

(22) Stop light switch - rear wheel brake

(23) Stop light (in tail lighting fitting top)

(24) Flasher unit

(25) Switch for direction indicators (switch combination at handle-bars)

(26) Tell-tale light for direction indicators (only deluxe model)

(27) Flashing-light direction indicator, front, left-hand side

(28) Flashing-light direction indicator, rear, left-hand side

(29) Flashing-light direction indicator, front, right-hand side

(30) Flashing-light direction indicator, rear, right-hand side

(30a) Socket outlet for flashing-lights (only for side-car operation)

(31) Graphical symbols for:
a Flat plug
b Receptacle for flat plug or socket outlet
c Ground
d Detachable connection (screw, terminal)
e Non-detachable connection

LVR Cable connector in headlamp, right-hand side
o top
u bottom
v front
x occupied connection

LVL Cable connector in headlamp, left-hand side
o top
u bottom
v front
x occupied connection

LVF Cable connector at chassis, at filter bowl top
v front
h rear
x occupied connection

Si fuse box
l left
r right

MA ground point headlamp

MB ground point combined stop-tail-number-plate lighting fitting

ML ground lamp for headlamp

MC ground point of vehicle (at cable connector at chassis)

MD ground point of dynamo

MT ground point of tachometer

Cable colours:

German abbreviation	Meaning
br	brown
rt/sw	red-black
sw	black
sw/ws	black-white
ws/sw	white-black
gr	grey
gn/rt	green-red
bl	blue
ge	yellow
rt	red
sw/rt	black-red
sw/bl	black-blue
sw/gn	black-green
ws	white
gn	green
gn/bl	green-blue
bl/ws	blue-white
rt/ge	red-yellow
br/sw	brown-black

1) dash-dotted line represents conductors which are only present in the standard design

2) dashed line represents conductors which are only present in the deluxe model

6.6. Instruments and Tell-tale Lights

The arrangement of instruments is shown in Fig. 177. The standard design of the ETZ 250 is only provided with one tachometer (at the right of the instrument pod).

In addition to the tachometer, also arranged at the right, the deluxe model is provided at the left with a speedometer (revolution counter) mechanically driven by the crankshaft (see also Fig. 88).

Arrangement and meaning of the tell-tale lights are indicated in Fig. 185. As to the wiring and interconnection with other electrical devices, the necessary information is given in the Circuit Diagram, Fig. 184.

Tachometer and revolution counter are illuminated in night operation. For this purpose, the lamps marked by (3) in Fig. 186 are used which get ground via the flat plug connection (4). The function of the lamps indicated by (1) is illustrated in Fig. 185.

The electrical potential for the control lamps (1) is fed via the flat plug connections (2).

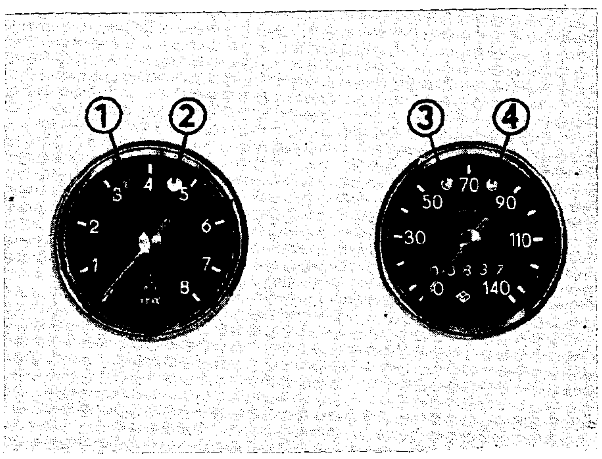


Fig. 185. Arrangement of the tell-tale lights

(1) *Idling indication*, yellow (only deluxe model)

(2) Control light for dynamo, red (only deluxe model)

(3) High headlight beam control, blue

(4) Control of direction indicators, green (in the standard design of the motor-cycle, this is also the control light for the dynamo)

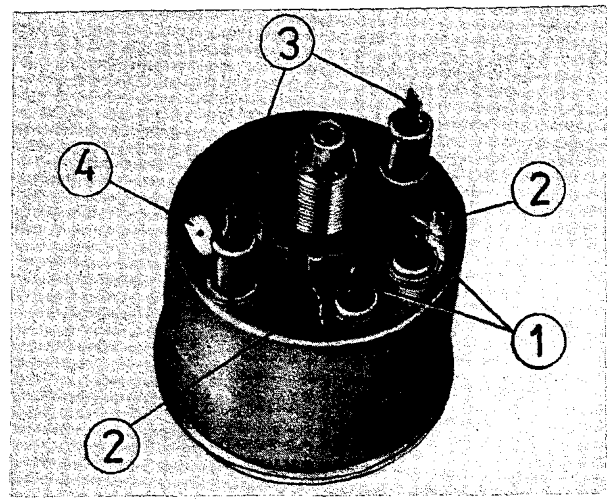


Fig. 186. Arrangement of the lamps in the instruments

Removal of the lamps from the instruments becomes possible after withdrawing the flat plugs from the vertical connections of the lamps. Then the lamps can easily be drawn from the instrument casing.

7. Induction System

7.1. Description and Function of the System

The entire induction system is an integrated system which is optimally adapted to the engine. Any change in this system will have a detrimental effect on the power, the consumption, the wear, etc.

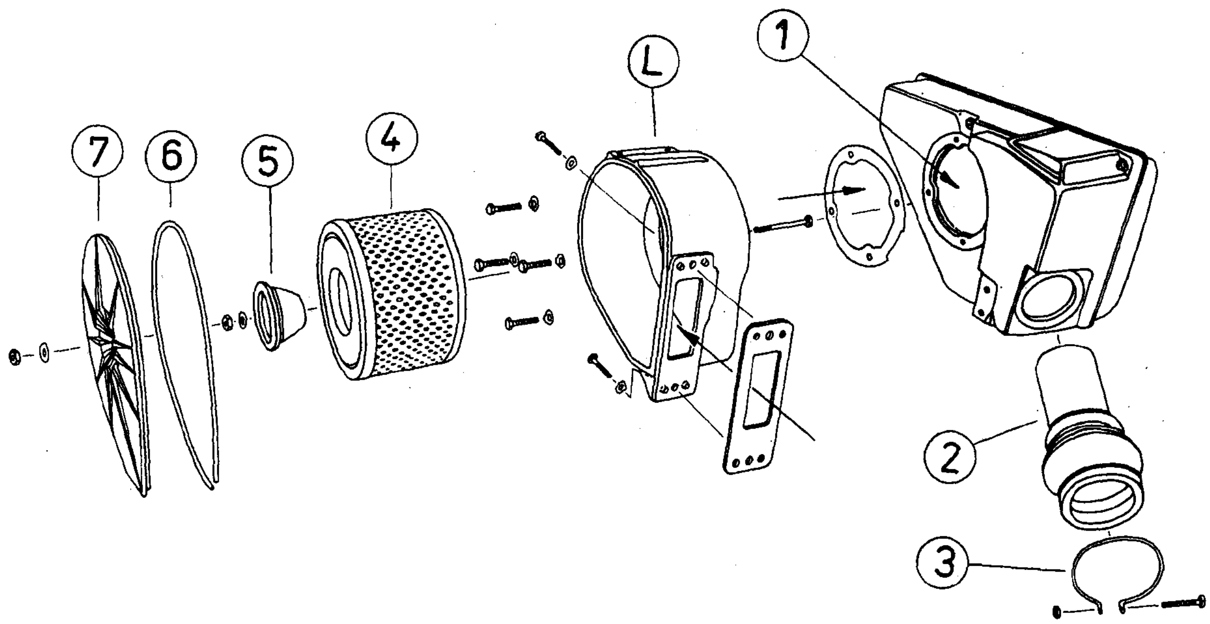


Fig. 187. Intake silencer and air filter

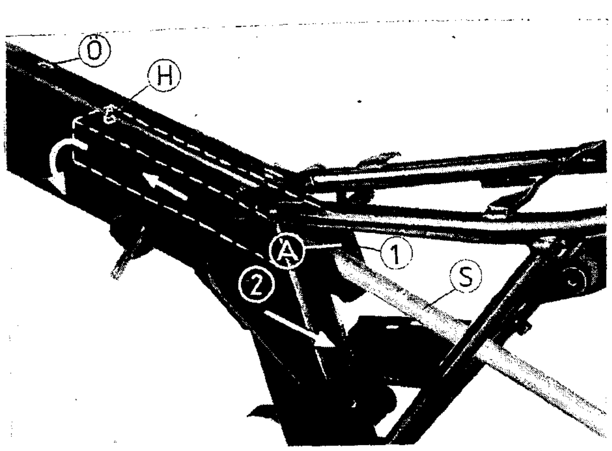


Fig. 188. Induction pipe mounting

The induction system begins at the opening arranged under the regulator and ends at the intake port of the cylinder. In the entire system no point must allow the admission of additional air apart from the holes provided for this purpose.

The air, and from the carburetter the fuel-air mixture must take the following course in order to get into the crankcase:

The air is drawn in through the opening (A) of the induction pipe (1), see Fig. 188. The induction pipe serves for silencing and stilling of the air.

After leaving the induction pipe, the air flows back into the frame member and enters the air filter casing (L) tightly screwed to the frame tube, see Fig. 187.

When passing through the air filter, the air is purified. The dust particles in the air are retained by the filter. Subsequently, the pressure differences induced by the induction vibrations are equalised to a great extent in the intake silencer compartment (1).
Then the air is drawn in the connecting piece (2), fastened to the carburetter by the clamping ring (3), and passes through to the carburetter.
In the carburetter, the arriving air is mixed with the atomised fuel in a certain ratio. This fuel-air mixture then passes through the intake port into the crank compartment of the engine casing.

7.1.1. Air Filter

For the ETZ, a dry air filter is used. The air filter (4) is arranged in the filter casing.
It is centred with the one face in the casing and with the other face in a cup (5) which is guided on a threaded bolt and fastened on it (Fig. 187).
In order that the filter is properly sealed at its two faces, the cup (5) and the cover (7) must be screwed in such a way that the air filter is properly fixed and the packing (6) can fulfil its function.

The filter will be accessible after the removal of the battery. The dust is deposited on the exterior surface of the filter. This must be taken into consideration when cleaning it. The dry air filter is cleaned by slightly tapping it or by brushing by means of a dry and clean hair brush..

7.1.2. Intake Silencer

The intake silencer consists of two light metal castings which are screwed together so that they cannot be detached.
In this casing, the air filter casing (L) is fastened.
The silencer compartment (1) serves for the observance of the specified sound level of the induction noise and also as reservoir for the air required by the engine for combustion.
The intake silencer is connected with the frame by means of three screws.

The intake hose (1), which also serves for silencing, see Fig. 188, is fastened to the rear of the frame member directly in the cut of the plate by means of a groove in the rubber. A lug at the front end of the hose (H) keeps the latter in the opening (O) of the frame member.

Replacement of the intake hose becomes possible after demounting the induction system, the rear-wheel mudguard and the rear wheel.
A broom-stick (S) or another wooden rod facilitate the insertion of the lug (H) into the opening (Ö).

7.1.3. Connecting Piece at Carburetter

The connecting piece is a rubber moulding which establishes the connection between intake silencer and carburetter.
Care must be taken that the wall of the drill-hole in the intake silencer casing is properly seated in the groove in the connecting piece provided for this purpose and that the other end of the connecting piece is firmly connected with the carburetter with the help of a clamping ring.

The connecting piece must be checked for porous spots, especially within the range of folds, from time to time.

7.1.4. Carburetter

In the ETZ, a BVF-carburetter of type 30 N 2-5 is employed. This is a carburetter with a cold-starting device.

7.1.4.1. Design and Function of the Carburetter

The carburetter consists of two systems. In order to familiarise oneself with the design and function of them it is advisable to explain each system separately.

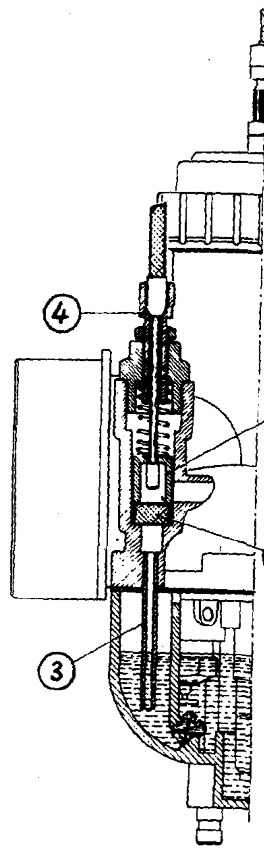


Fig. 189. Starting piston closed (driving position)

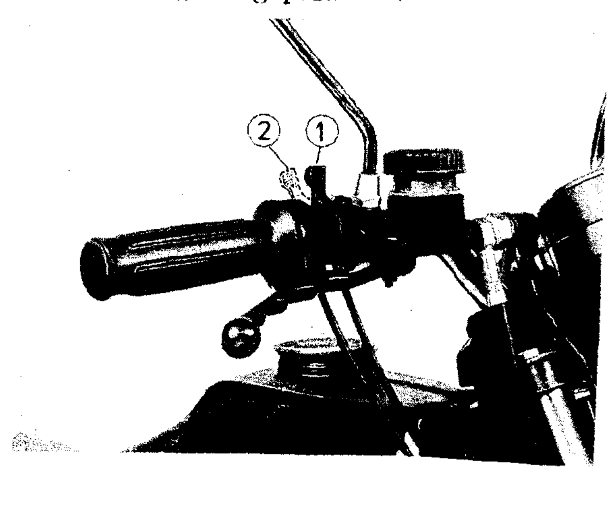


Fig. 190. Lever for starting carburetter
(1) Driving position
(2) Position for cold starting

1. COLD STARTING DEVICE

As the name indicates, this is a device for facilitating the starting of the engine in a cold state.

The cold starting device is shown in Fig. 189 (driving position, lever for starting carburetter at the handle-bars contacts the front stop) and in Fig. 191 (cold starting, lever for starting carburetter at the handle-bars is drawn towards the driver).

In the driving position of the lever for the starting carburetter at the handle-bars, the packing (2) at the starting piston (1) must completely seal the starting mixing tube (3).

The cable control adjusting screw (4) must, therefore, always be set in such a manner that a play of about 1 mm is present between cable control sheath and adjusting screw.

When the lever for the starting carburetter at the handle-bars is set to cold starting position (the lever is drawn towards the driver), then the starting piston with packing is lifted and, thus, the upper opening of the starting mixing tube (A), Fig. 191, is released.

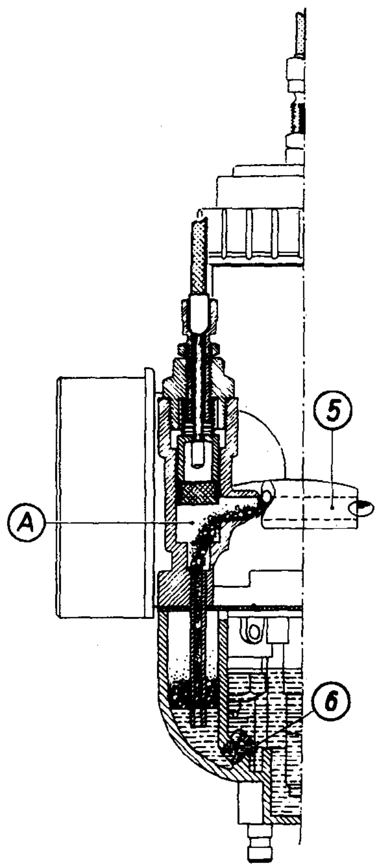


Fig. 191. Starting piston lifted (cold starting)

The fuel in the starting mixing tube is sucked up when the engine is started and then passes through the starting duct (5), Fig. 191, which ends in the suction port after the throttle valve.

In order to ensure the required under-pressure for cold starting in the starting system, the throttle valve must be in the idling position.

The starting device is ineffective when, in starting the engine, the throttle valve is lifted beyond the idling system!

The lower opening of the starting mixing tube ends in a separate space, the starting compartment, which is connected with the compartment for the central float through the starting jet (6), Fig. 191.

The drill-hole of the starting jet is arranged in such a way that, after the sucking off of the amount of fuel standing in the starting mixing tube, only such an amount of fuel is allowed to follow that the engine, with the starting lever drawn for a long time, can just process the too rich mixture.
The fuel required for starting is premixed in the starting compartment.
The air required for this purpose is sucked up from the compartment for the central float through a recess in the upper edge of the partition wall. The central float is aerated through an overflow tube (15), Fig. 196, which is arranged in the centre of the float chamber.

2. CARBURETTER

The fuel flows through the float valve (16 in Fig. 192) into the float chamber. When the fuel level has reached a certain height (Fuel level), the float needle valve is closed by a sheet-metal nose (17), Fig. 196, which is arranged at the holder of the float.

With the engine running, due to accelerating, the partial load needle is lifted more or less from the needle valve (18) and, consequently, the throttle valve raised for the same amount.
The air sucked up by the engine flows through suction port of the carburetter and, hence, past the atomiser insert. As a consequence, the fuel is sucked up through the main jet (19) and needle jet to the suction port.

By the atomiser insert (18 in Fig. 196), the fuel is atomised and mixed with the air flowing through. This ignitable fuel-air mixture is then conducted to the engine.

The formation of an ignitable mixture in idling is due to the idling jet and the specified setting of the slow-running air screw (see Fig. 192, Nos. 8 and 11).

The correct mixing ratio between fuel and air in the partial-load range is brought about by the needle position, that is to say, the notch in the needle holder into which the partial-load needle is suspended.

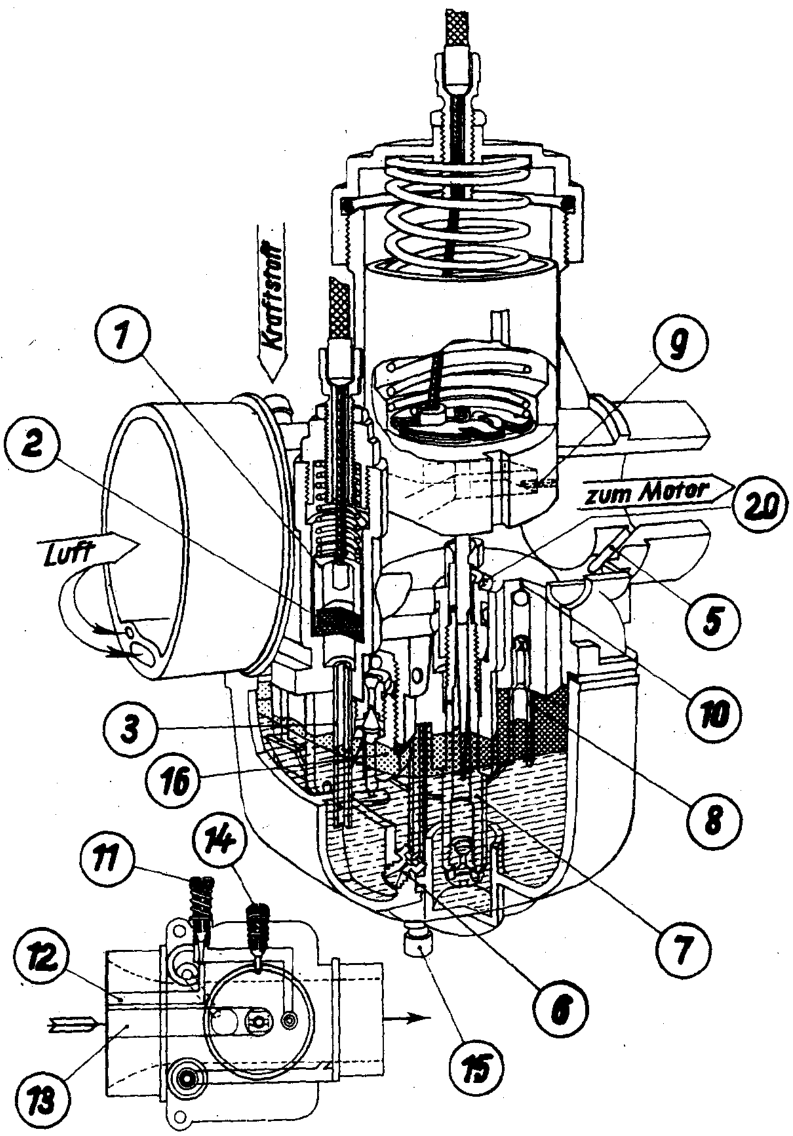


Fig. 192. Carburetter BVF 30 N 2-5 (starting carburetter), sectional view
(1) Starting piston
(2) Seal washer
(3) Starting mixing tube
(5) Starting duct
(6) Starting jet
(7) Needle jet with main jet
(8) Idling jet
(9) Idling duct
(10) Transfer port
(11) Slow-running air screw (unscrewed)
(12) Idling air duct
(13) Mixing air duct
(14) Throttle stop screw
(15) Vent tube for float chamber
(16) Float valve
(20) Atomiser insert

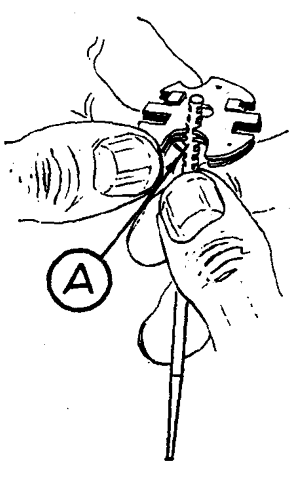


Fig. 193. Partial-load needle with holder

The needle holder not only fixes the needle for partial load but also guides this needle (upper plate of the needle holder).
For setting the needle, the lower plate (A) of the holder is decisive (Fig.193).
The needle holder lies flat on the bottom of the throttle valve. The latter in turn, displaceable axially in its guide, is pressed into its initial position (idling position) by a spring which is supported by the closing cap. The spring force acts against the cable control force (see Fig. 192).

7.1.4.2. Fuel Level Basic Adjustment

For the combustion in the engine an ignitable fuel-air mixture in the ratio of 1 : 15 (mean value) is required.
When this ratio is changed, e.g. by the admission of more air (1 : 18), the mixture will become too lean.
When the air proportion is too small, e.g. 1 : 13, it will become too rich and is hardly ignitable.

The fuel level to be kept constant in the float chamber is regulated by the float needle valve and the float.

The adjustment of the fuel level substantially contributed towards the formation of this fuel-air ratio.

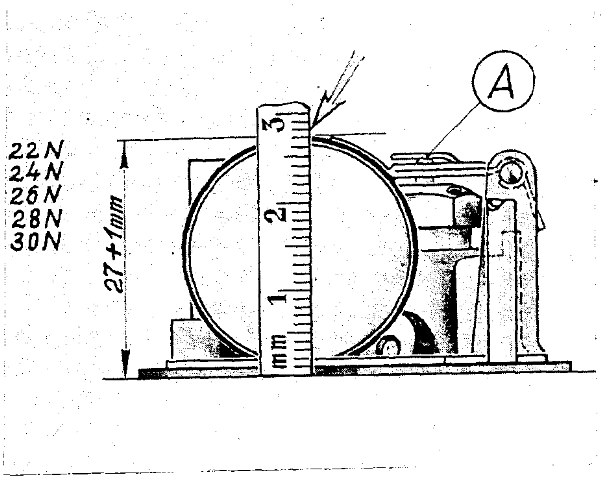


Fig. 194. Float valve closed, measured without packing

(A) Closing plate

A fuel level set too high means - too rich a mixture; a fuel level set too low means - too lean a mixture. Therefore, the basic adjustment of the fuel level is of particular importance.

Please, take the illustrations Fig. 194 and 195 into cinsideration!

For the basic adjustment of the fuel level always start from the fact that the tongue (A) in Fig. 194 must be parallel to the holder of the float. An extremely bent tongue (A) means that the holder of the float is distorted at the lower soldering joint (kink angle). In this case, the floats must be reset to the basic dimension 30.0 mm (with the float valve closed and the damping of the float needle not depressed) uniformly(in the kink angle, lower soldering joint).

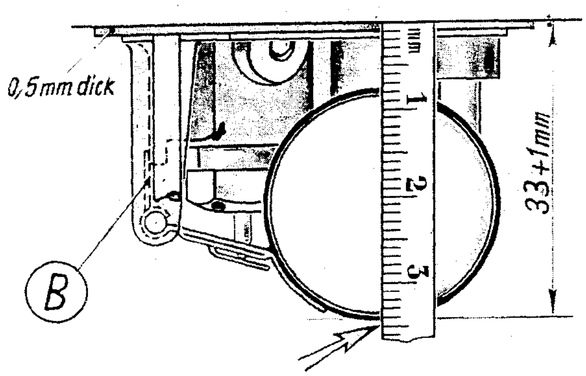


Fig. 195. Float valve fully open, measured without packing

(B) Stop tongue

The dimension (27 mm) given in Fig. 194 means fully spring-loaded damping of the float needle - a slight correction is, effected at the tongue (A).

NOTICE:

On no account should the tongue (A) be bent downward towards the holder of the floats because in this event the float needle valve will not be opened sufficiently so that fuel is admitted at a slow rate, a fact, which leads to too lean a mixture with increasing rotational speeds of the engine!

The dimension (33 mm) given in Fig. 195 limits the float travel downwards and can be readjusted at the stop tongue (B).

NOTICE:

The float travel must not be smaller than 6 mm (the difference between 33 and 27 mm)!

7.1.4.3. Fuel Level - Fine Adjustment

If a level testing equipment is not available, the fuel level can be measured directly at the carburetter in the vehicle. For this purpose, an old float chamber is required which is provided with a cut, 20 mm wide and 25 mm long, in the narrow end so that the float needle valve becomes visible and which is closed with a piacryl plate glued in place. A separate application adhesive should be used.

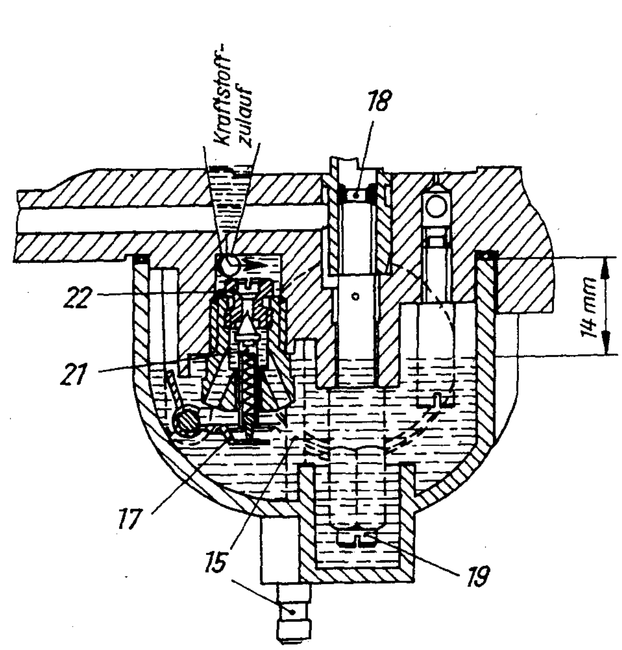


Fig. 196. Carburetter lower part (sectional view) fuel level
(15) Vent tube for the float chamber
(17) Closing plate of the float valve
(18) Needle jet with jet carrier
(19) Main jet
(21) Spring-loaded float needle
(22) Float valve, complete

On the piacryl plate glued in place, the dimension of 14 mm, starting from the sealing surface, is projected.

The float chamber prepared in this way is attached with PACKING to the carburetter to be measured. An accurate measurement depends on the fact that the flow rate of the fuel is 12 l per hour. The fuel tank must be at least half full in order that the specified pressure on the float needle valve is given.

Plug the carburetter, which is cleaned and checked for proper basic adjustment, into the fuel hose and open the fuel cock. Fuel will be admitted into the float chamber until the float lifted by the raising fuel level closes the float needle valve, thus, interrupting the fuel feed. The level now actually present in the float chamber is compared with the marking at the inspection glass and, if required, corrected by readjusting the tongue (A), Fig. 194.

When the float needle valve is leaky, this is indicated by the dripping vent (15), Fig. 196. In this case, demount the valve and once more carefully clean it. If it then is still leaky, it must be replaced by a new one.

The fuel level is 14 ± 1 mm measured from the top edge of the float chamber.

7.1.4.4. Idling Adjustment

NOTE:

1. The carburetter should be adjustend when the engine still has operating temperature. The vehicle must stand on plane ground.
2. The idling position of the throttle valve should not be set by means of the adjusting screw for the throttle cable control but by the stop screw for the throttle valve.

The stop screw (14) for the throttle valve is adjusted in such a way that the engine runs perfectly smooth. Then the slow running air screw (11) is fully turned down and slackened back through one revolution. Subsequently, the slow running air screw is screwed down and back for trial to find the maximum rotational speed of the engine. When it has been found, the stop screw for the throttle valve must be set in such a way that the engine again reaches the idling speed (see Fig. 192).

This process must be repeated until the engine speed will no longer change when the slow running air screw is adjusted.

When, at the beginning of the adjusting operations, the speed does not change when the slow running air screw is regulated, then the idling jet is clogged.

If this adjustment is performed correctly, then the engine will show a perfect transition from idling to the partial load range.

7.1.5. Intake Connection

It is the task of the intake connection to fix the position of the carburetter and to establish the connection between carburetter and inlet port of the cylinder. It is fastened to the cylinder by means of hexagon nuts and stud bolts.
In order that the heat from the cylinder is not transmitted to the carburetter, a plastic flange and two packings are inserted (in front of and behind the plastic flange) between the intake connection and the cylinder.

7.2. Fault Localisation

7.2.1. Too Lean a Mixture

The fact that the fuel-air mixture becomes too lean is identified by the following features:

1. Severe burning of the electrodes of the sparking-plug;
2. Beads appear at the sparking-plug;
3. Within the range from half to full throttle, the power delivered by the engine is too low;
4. The engine tends to become stuck!

Faults and defects which cause the mixture to become too lean and their remedies:

1. Air filter fails to fit properly in the centring collar of the intake silencer casing
   - Remove the air filter and fit it correctly in the centring collar.
2. After improper handling, the air filter has been damaged.
   - Replace the air filter by a new one.
3. Packings between air filter casing and intake silencer or between air filter casing and frame defective.
   - Replace the packings or re-tighten the screwed connections.
4. Packing between air filter casing and cover missing or defective.
   - Fit a new packing or replace the old one by a new one
5. Connection to carburetter is defective or porous or it fails to fit properly in in drill-hole of the intake silencer casing.
   - Replace the connecting piece by a new one or align it.
6. Intake socket porous.
   - Replace the intake socket by a new one or - if still possible - seal it by means of artificial resin.
7. Insulating flange broken or porous; packings defective.
   - Replace the parts in question by new ones.
8. Fuel feed insufficient due to:

   dirty fuel cock,

   compressed rubber seal ring,

   hardened or defective fuel line,

   clogged vent hole in tank cover.
   - demount the fuel cock and clean its parts separately,
   - defective and hardened fuel lines and and the damaged rubber packing must be replaced by new ones,
   - the hole in the tank cap must be cleaned by blowing compressed air through it.
9. The partial-load needle is suspended too deep.
   - The partial-load needle must be suspended at one or more notches higher until the normal mixing ratio is reached.

10. Central float is distorted - float valve is insufficiently opened
    - Adjust the central float.
11. Float needle jams
    - Polish the float needle and through bores in the valve body,
    - Check the velve for foreign particles,
    - Replace the float needle and the valve seat for new parts.

7.2.2. Too Rich a Mixture

The fact that the fuel-air mixture becomes too rich is identified by the following features:

1. Starting the engine is difficult;
2. Engine power output drops with increasing temperature of the engine;
3. High fuel consumption;
4. Inclination to simulate a "four-stroke engine";
5. Sparking-plug with the specified calorific value is oiled up;
6. Formation of smoke intense and visible in the state when the engine has operating temperature.

Faults and defects which cause the mixture to become too rich and their remedies:

1. Dry air filter is too old (more than 10,000 km of road operation)
   - Replace the air filter by a new one.
2. Dry air filter has become wet

   Cause: Air filter casing not tight - water has entered
   - Dry the air filter, replace it, if required.
3. Partial-load needle is suspended at a notch which is at too high a level
   - Suspend the partial-load needle lower for one or more notches until a normal ratio of mixing has been reached.
4. Needle jet and partial-load needle worn (more than 20,000 km of road operation)
   - Replace the two parts by new ones.
5. Float valve leaky

   Cause: 1) valve dirty,
   2) float needle worn
   - Clean the float valve,
   - Fit a new float needle.
6. Central float distorted - float valve remains open too wide
   - Adjust the central float.
7. Main jet too large
   - Use another main jet with the same dimension printed on it (jets with the same nominal dimension differ by their tolerances),
   - If this fails to be a remedy, use the next smaller jet.
8. Packing in starting piston damaged
   - Replace the packing by a new one.
9. Spring for starting piston has an insufficient pre-tension
   - Replace the spring by a new one.
10. Sheath of the cable control for the starting device has no clearance; consequently, the starting piston cannot seal properly the starting mixing tube
    - Adjust the cable control sheath so that a clearance of 1 mm is given.

8. Special Tools

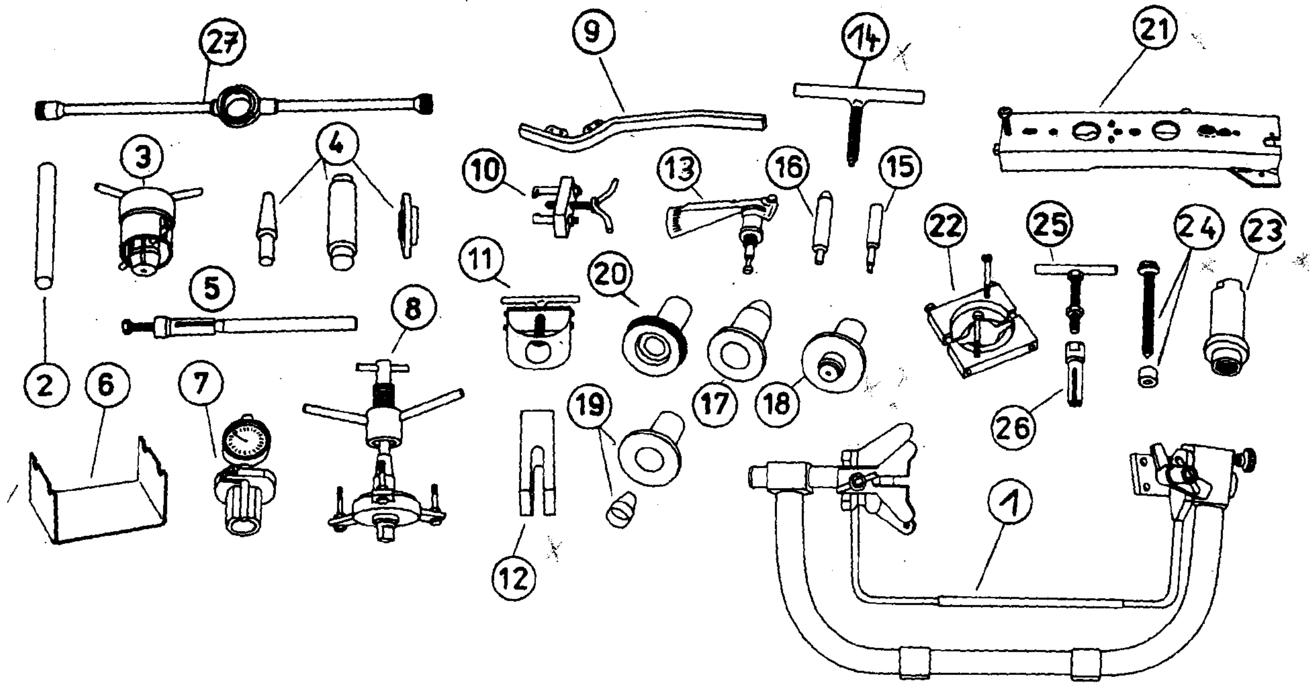


Fig. 197. Range of Special Tools for the ETZ 250

8.1. List of Special Tools

		Spare Reference No.	Drawing No.
1	Engine assembling device	22-50.014	1a
	Clamping piece rear 1)	89-99.321	1b
	Clamping piece, front complete 1)	89-99.322	1c
2	Centring bolt for swing-fork (05-MW 26-4)	89-99.055	2
3	Extractor for bearing in control head	22-51.006	3
4	Fitting device for rubber bearing in swing-fork	22-51.445	4
5	Expanding mandrel for wheel bearing (H 8-820-3)	89.99.090	5
6	Assembly device for gearbox	29-50.011	6
7	Measuring instrument for end play of clutch driver (05-ML 13-4)	89-99.117	7
8	Clutch clamping device (05-MV 150-2)	89-99.071	8
9	Holding-up device for gearbox sprocket wheel (05-MW 45-3)	89-99.057	9
10	Extractor for driving gear (05-MV 45-3)	89-99.064	10

1) For the completion of engine assembling devices purchased up to 1980 for the ETZ 250 engine

		Spare Reference No.	Drawing No.
11	Pressing-out device for gudgeon pin	22-50.010	11
12	Piston support	22-50.412	12
13	Ignition timing gauge	29-50.801	without
14	Anchor pulling screw (02-MW 39-4)	89-99.026	13
15	Drift for locating sleeves (11-MW 3-4)	89-99.072	14
16	Guide mandrel for gudgeon pin (05-MW 19-4)	89-99.051	15
17	Drift for bearings 6203 and 6204 (11-MW 7-4)	89-99.073	16
18	Drift for bearing 6306	29-50.405	17
19	Fitting tool for packing ring 30 x 72 x 7, dynamo side	29-50.406	18
20	Fitting tool for packing ring 30 x 72 x 7, clutch side	29-50.409	19
21	Assembling bridge	22-50.430	20
22	Ball bearing extractor (bearing 6306)	22-50.431	21
23	Pulling sleeve (clutch - thread M 24 x 1.5)	22-50.435	22
24	Pressing spindle for pressing piece	22-50.437	23
25	Extracting screw for bearing 6203	22-50.438	24
26	Clamping cartridge	22-50.439	25
27	Fitting wrench for telescopic fork (19-MW 22-1)	89-99.136	without
	Spacer ring	not included in this range	26
	Piston ring pliers (05-MW 141-4)	89-99.124	27
	Clamping ring (05-MW 147-4)	89-99.128	28
	Special spanner for shock absorber (05-MW 82-4)	89-99.059	29

8.2. Drawings of Special Tools

1. Engine Assembling Device 22-50.014

All assembling devices sold by MZ until 1980 cannot be used for holding the engine of type EM 250.

The MZ Spare Sale Department offers for modifying these older devices modification sets consisting of

clamping piece 89-99.321, rear and

clamping piece, front complete, 89-99.322

to customers entitled to purchase special tools.

In addition, the front clamping point at the 22-50.014 device must be modified according to drawing 1a; this is possible by means of the usual workshop tools.

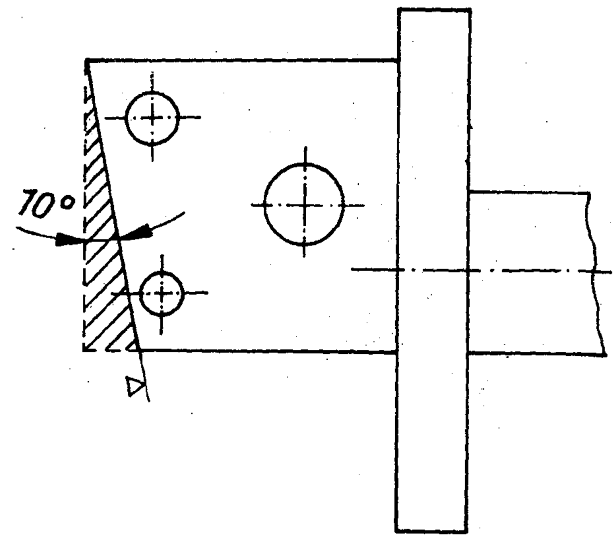


Fig. 1a. Modification of the clamping point of the assembling device 22-50.014

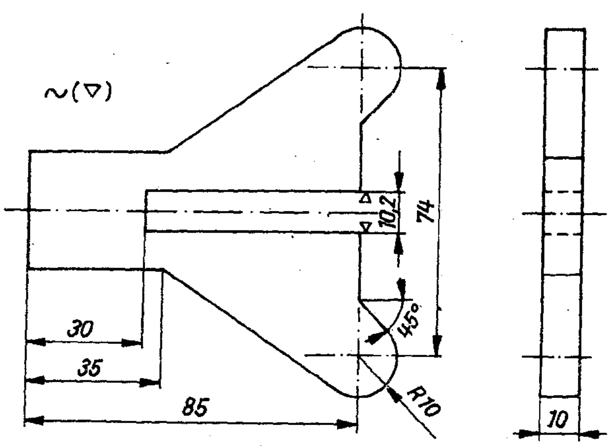


Fig. 1b. Clamping piece, rear, 89-99.321

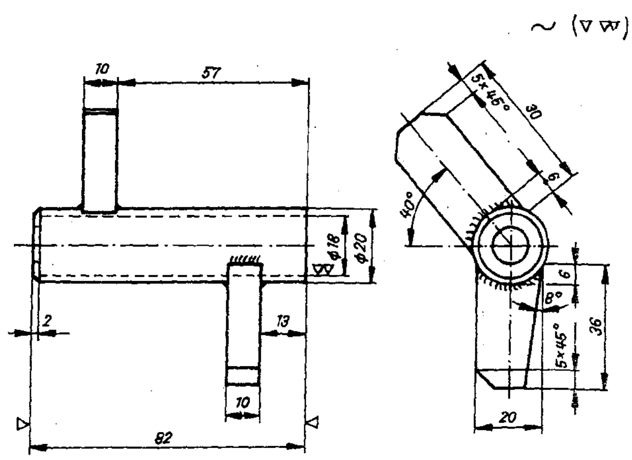
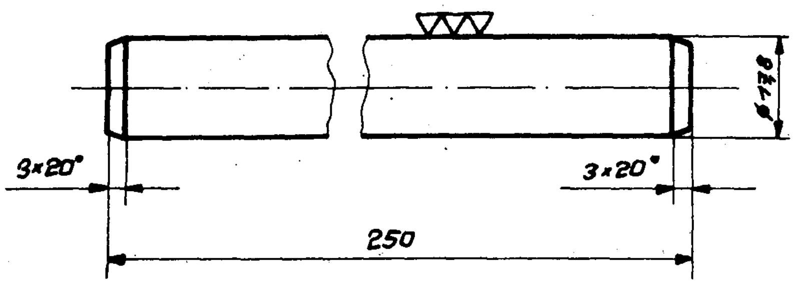


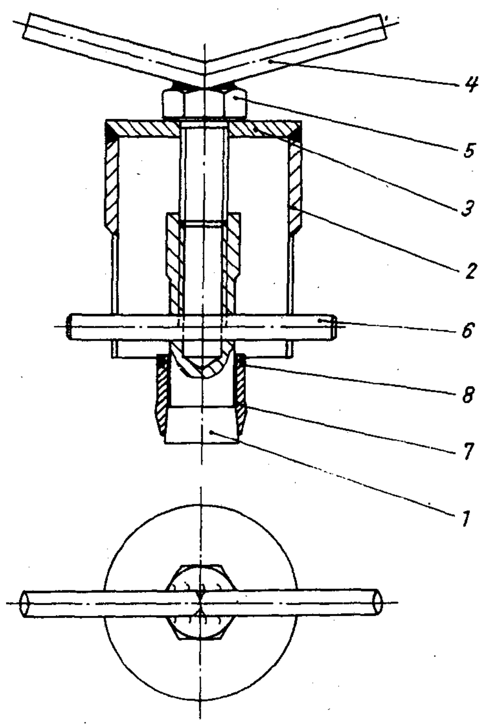
Fig. 1c. Clamping piece, front, complete, 89-99.322

2. Centring bolt for swing-fork (05-MW 26-4) 89-99.055



Part	Quantity	Description	Material	Rough Size	Remarks
	1	centring bolt	C 15 K	Ø 18 x 255	case hardened

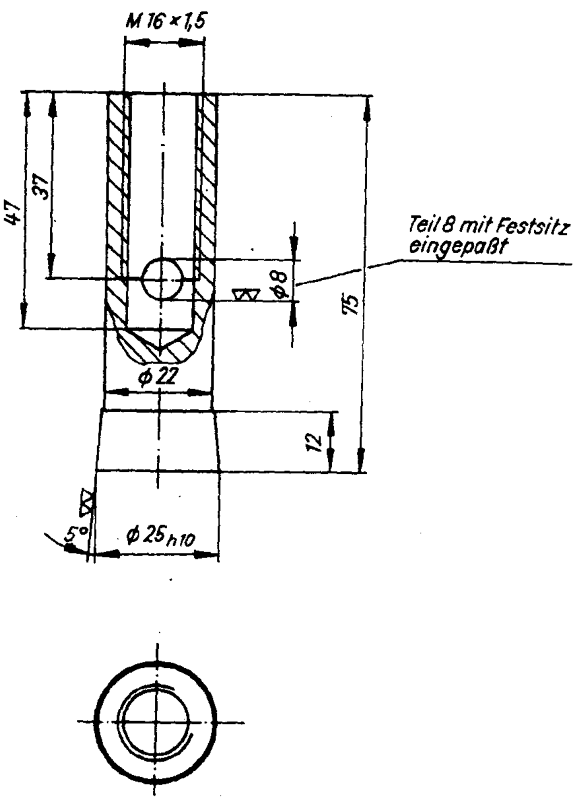
3. Extractor for bearing in control head 22-51.006



Part	Quantity	Description	Material	Rough Size	Remarks
1	1		C 45	Ø 30 x 80	hardened and tempered
2	1	pipe 76 x 10	St 35 hb	75 long)	welded part
3	1		St 38 b-2	Ø 65 x 10)	
4	1		St 38 b-2 K	Ø 8 x 130)	welded part
5	1	hexagon head screw M 16x 1.5 x 35		)	TGL 0-961
6	1		St 38 b-2 K	Ø 8 x 92	
7	1		16 Mn Cr 5	Ø 36 x 30	case hardened
8	1	circlip 28 x 1.6			TGL 0-9045

13

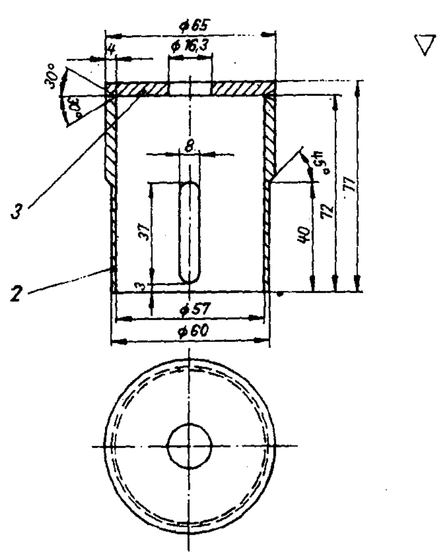
Part 1



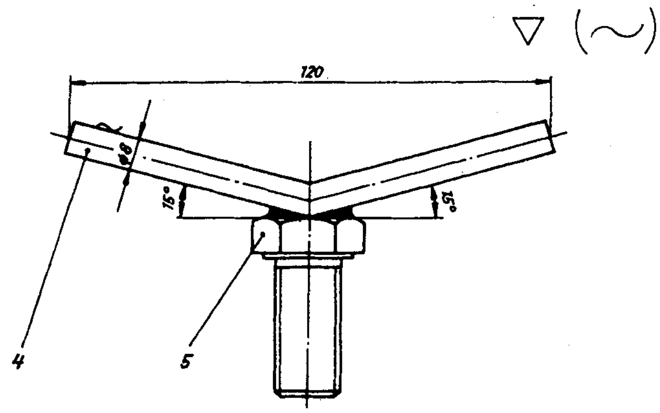
Teil 8 mit Festsitz eingepaßt = Part 8 mounted with tight fit

Nominal dimension	Allowance
25 h 10	0 - 0.084

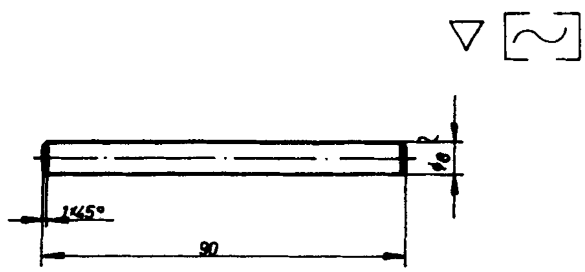
Parts 2/3



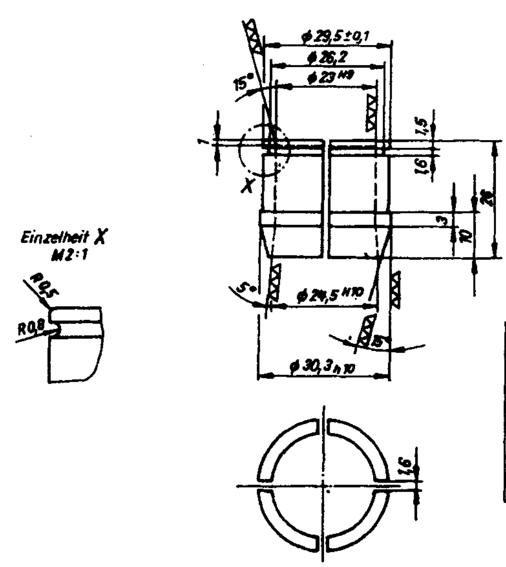
Parts 4/5



Part 6



Part 7



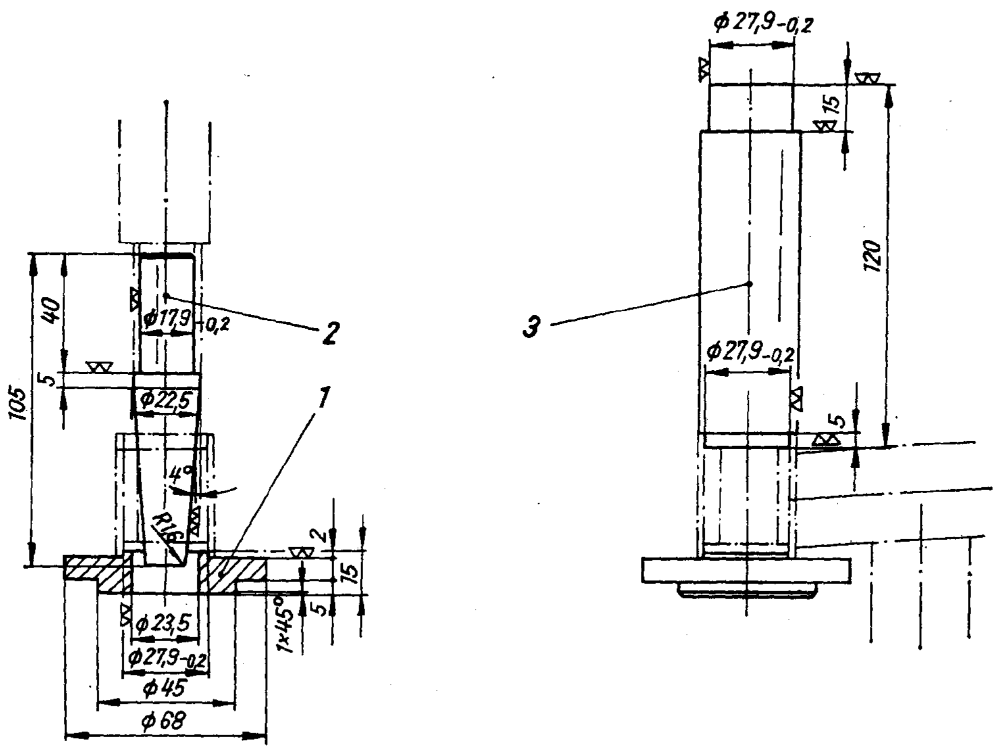
Paßmaß	Abmaß
23 H9	+0,052
	0
24,5 H10	+0,084
	0
30,3 h10	0
	-0,100

Einzelheit X
M 2 : 1 =
Detail X, scale 2 : 1

Paßmaß =
Nominal dimension

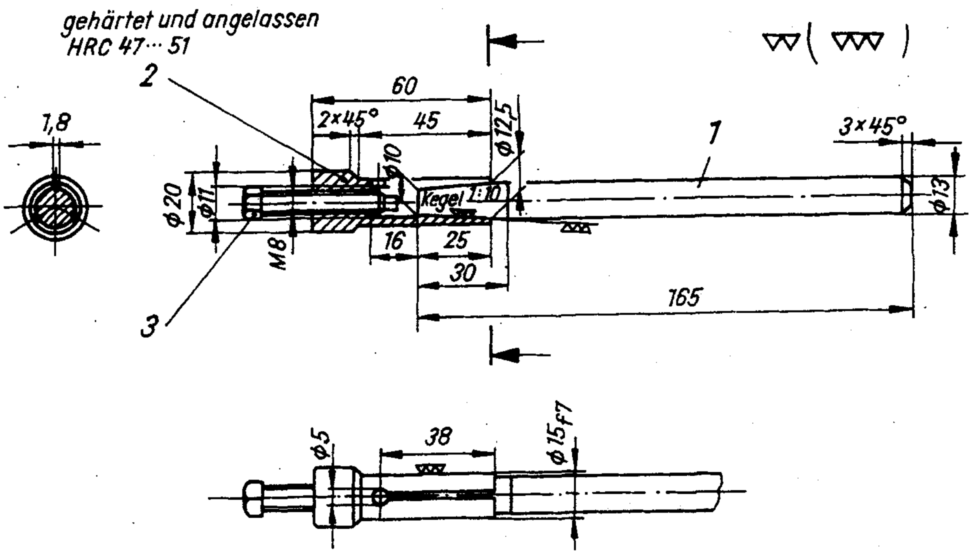
Abmaß =
Allowance

4. Fitting device for rubber bearing in swing-fork 22-51.445



Part	Quantity	Description	Material	Rough Size	Remarks
1	1		St 38 b-2	Ø 70 x 20	
2	1		C 45	Ø 23 x 110	nickel-plated
3	1		St 38 b-2 K	Ø 32 x 125	nickel-plated

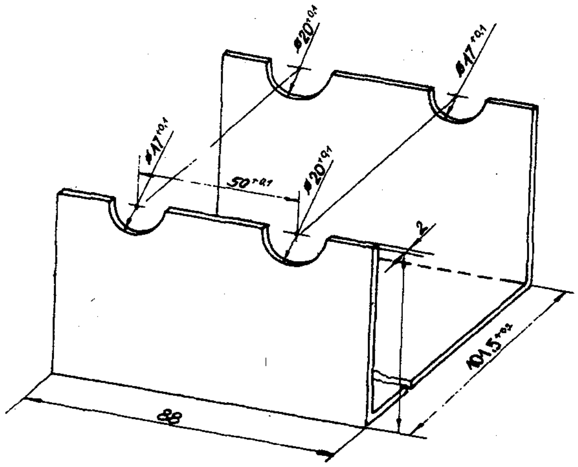
5. Expanding mandrel for wheel bearing (H 8-820-3) 89-99.090



gehärtet und angelassen = hardened and tempered
HRC 47·... 51 = HRC 47 to 51

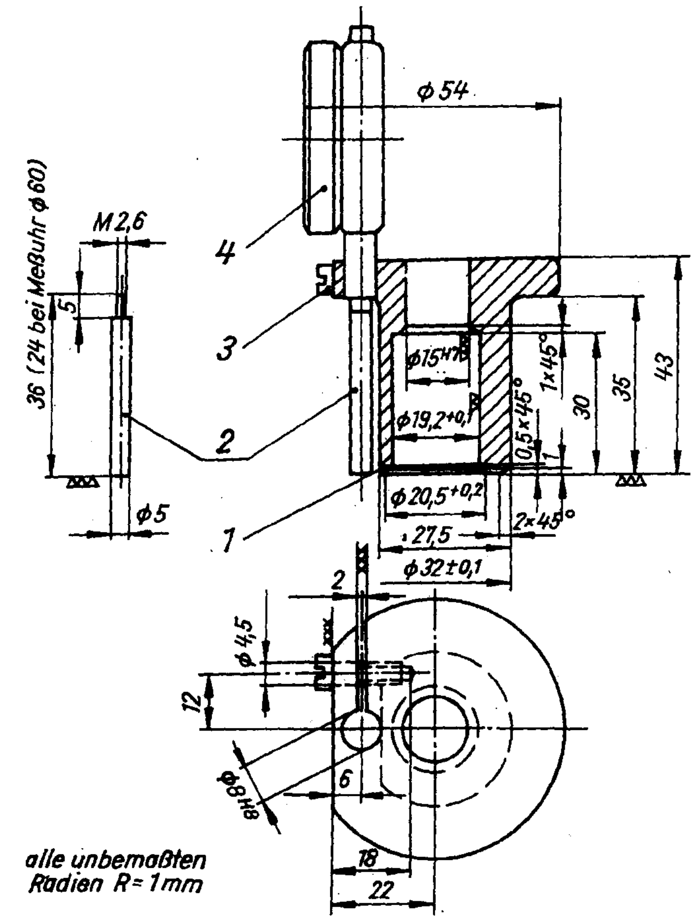
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	driver bolt	C 15	Ø 15 x 170	case hardened
2	1	expanding bush	67 Si Cr 5	Ø 25 x 65	
3	1	hexagon-head bolt M 8 x 45			TGL 0-561

6. Assembly device for gearbox 29-50.011



Part	Quantity	Description	Material	Rough Size	Remarks
	1		St Zu - A 2	2 x 88 x 205	

7. Measuring instrument for end play of clutch driver (05-ML 13-4) 89-99.117

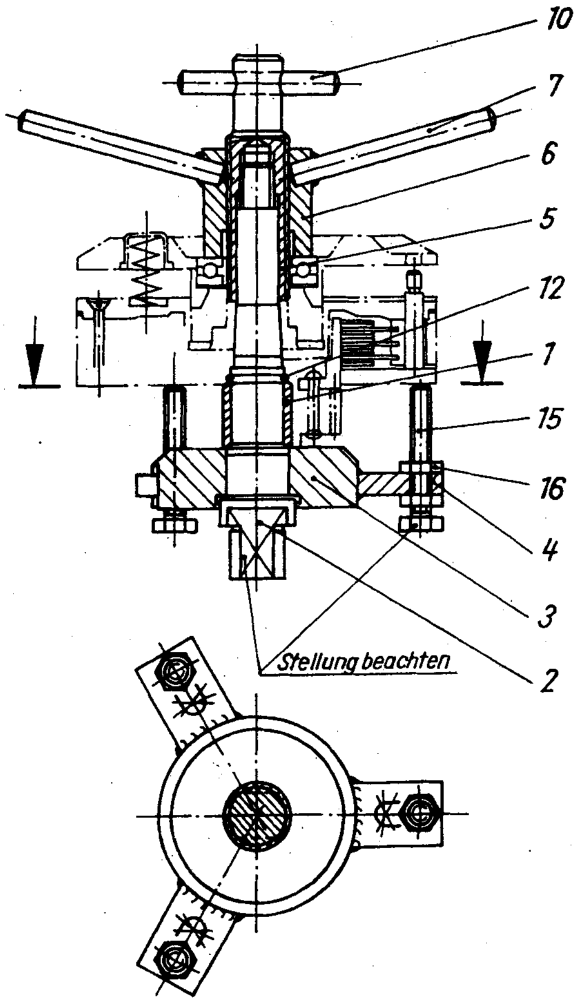


36 (24 bei Meßuhr Ø 60) =
36 (24 for dial gauge Ø 60)

alle unbemaßten Radien R = 1 mm = all radii without dimensions have a radius of R = 1 mm

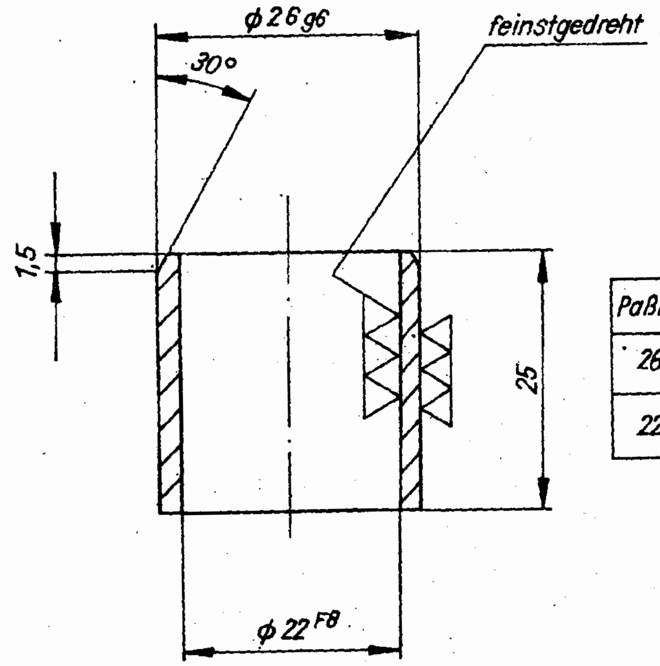
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	reception	C 15	Ø 60 x 48	case hardened
2	1	probe bolt	silver steel	Ø 5 x 40	
3	1	fillister-head screw M 4 x 12			TGL 0-84
4	1	dial gauge Ø 40			

8. Clutch clamping device (05-MV 150-2) 89-99.071



Part	Quantity	Description	Material	Rough Size	Remarks
1	1	pipe 28 x 4	St 35 hb	30 long	
2	1	crankshaft end	05-43.058		to be employed
3	1		St 38 b-2	Ø 80 x 26	welded part
4	3		St 38 b-2	10 x 30 x40	
5	1		C 45	Ø 30 x 96	
6	1		St 38 b-2	Ø 45 x 45	
7	2	cylindrical pin 10 m 6 x 80		welded part	TGL 0-7
10	1	cylindrical pin 8 m 6 x 60			TGL 0-7
12	1	circlip 22 x 2			TGL 0-9045
15	3	hexagon-head screw M 8 x 50			TGL 0-933
16	6	hexagon nut M 8			TGL 0-439

Part 1



Paßmaß	Abmaß
26 g6	-0,007 -0,020
22 F8	+0,053 +0,020

feinstgedreht = precision turned in a lathe

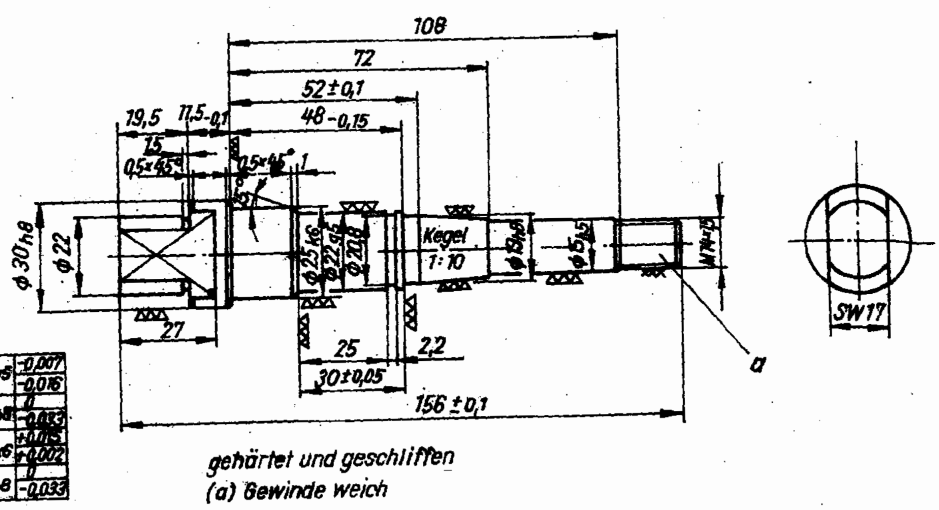
Kegel = cone

Paßmaß = nominal dimension   Abmaß = allowance

gehärtet und geschliffen = hardened and ground

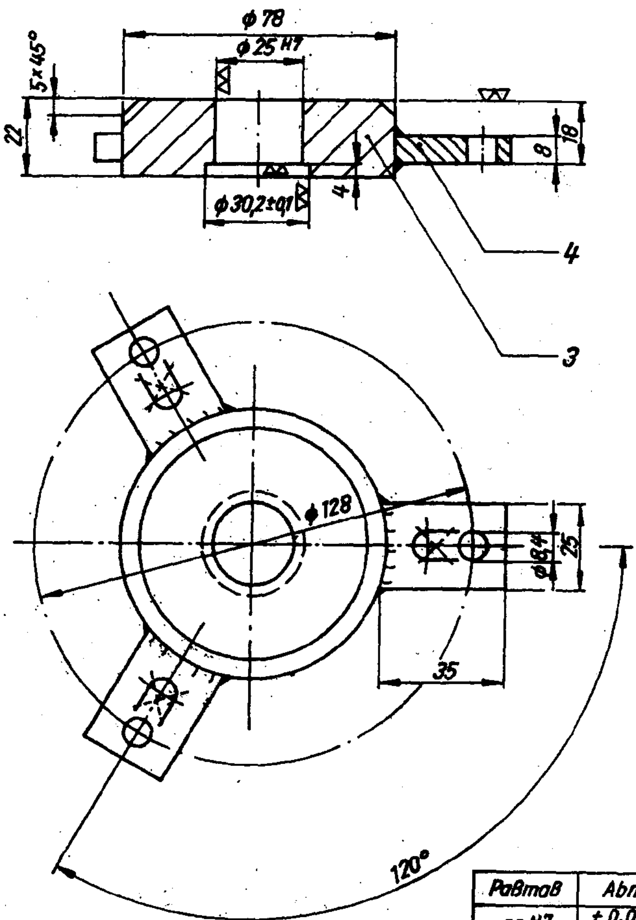
(a) Gewinde weich = (a) thread soft

Part 2



22 g5	-0,007 -0,016
19 h8	0 -0,033
25 k6	+0,015 +0,002
30 h8	0 -0,033

Parts 3/4



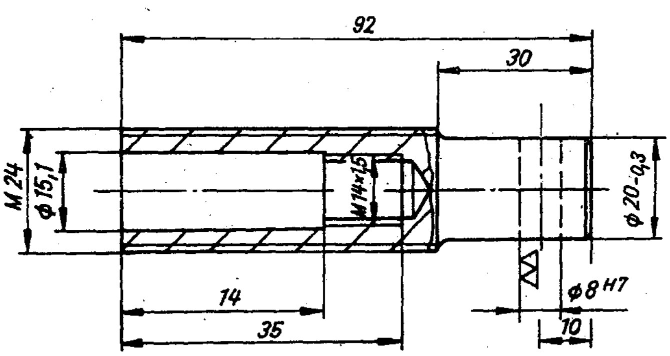
entfettet, phosphatiert

Paßmaß	Abmaß
30^{H7}	+ 0,021 / 0
25^{H7}	+ 0,021 / 0

entfettet, phosphatiert= degreased, phosphatised

Paßmaß = nominal dimension   Abmaß = allowance

Part 5

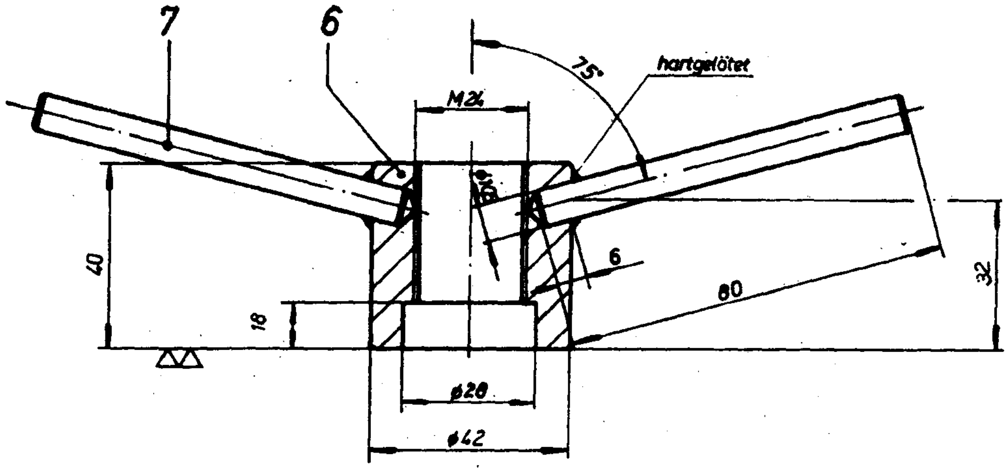


Paßmaß	Abmaß
8^{H7}	+ 0,015 / 0

Paßmaß = nominal dimension   Abmaß = allowance

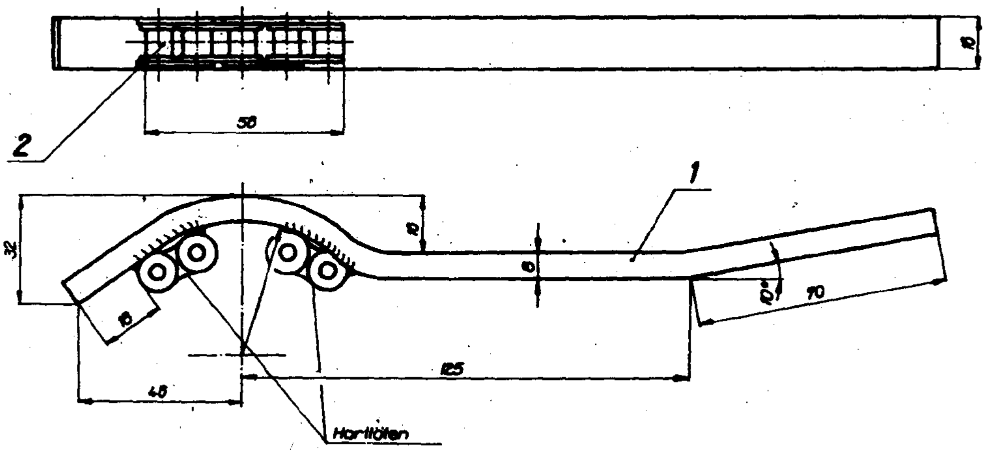
14

Parts 6/7



hartgelötet = brazed

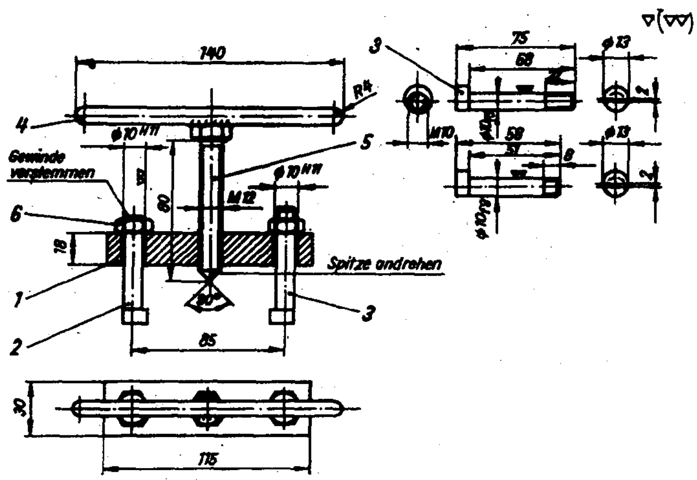
9. Holding-up device for gearbox sprocket wheel (05-MW 45-3) 89-99.057



Hartlöten = brazing

Part	Quantity	Description		Material	Rough Size	Remarks
1	1	wrench	) welded	St 34 K	16 x 8 x 270	TGL 0-1652
2	1	roller chain	} part		12.7 x 8.51	DIN 8180

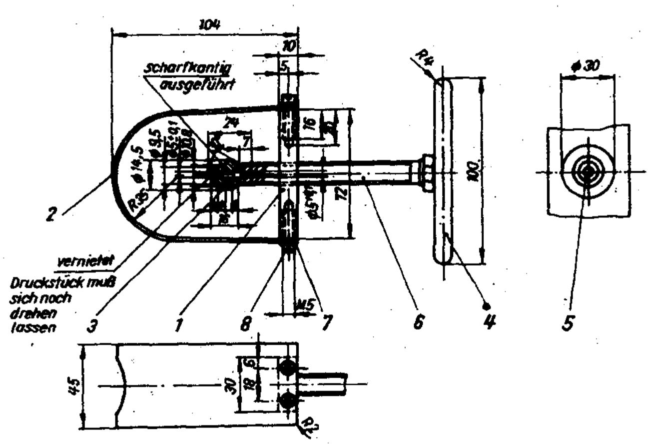
10. Extractor for driving gear (05- MV 45-3) 89.99.064



Gewinde verstemmen = thread to be caulked   Spitze andrehen = tip to be turned in lathe

Part	Quantity	Description	Material	Rough Size	Remarks
1	1		St 38 u-2	30x20x120	TGL 7973
2	1		C 45	Ø 18 x 62	TGL 7970
3	1		C 45	Ø 18 x 70	TGL 7970
4	1) welded		St 38 K	Ø 8x145	TGL 7970
5	1) part	hexagon-head screw M 12 x 80			tip turned
6	2	hexagon nut M 10			TGL 0-934

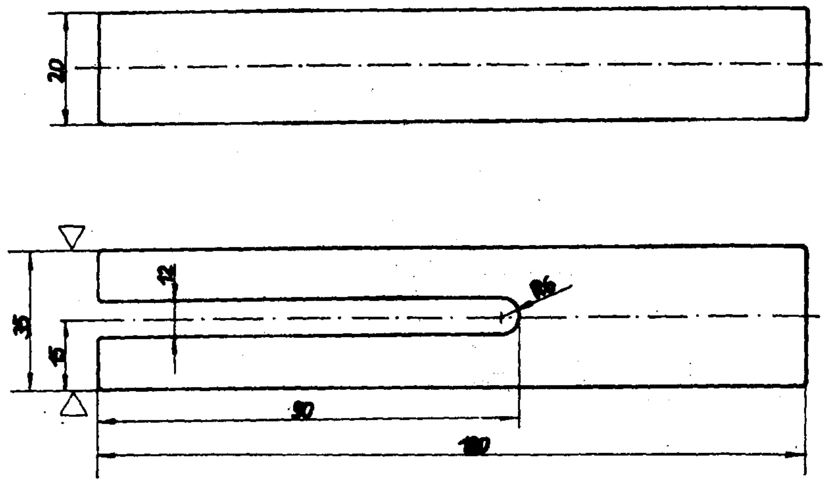
11. Pressing-out device for gudgeon pin 22-50.010



scharfkantig ausgeführt = provided with sharp edge   vernietet = riveted   Druckstück muß sich noch drehen lassen = thrust member must be capable of being turned

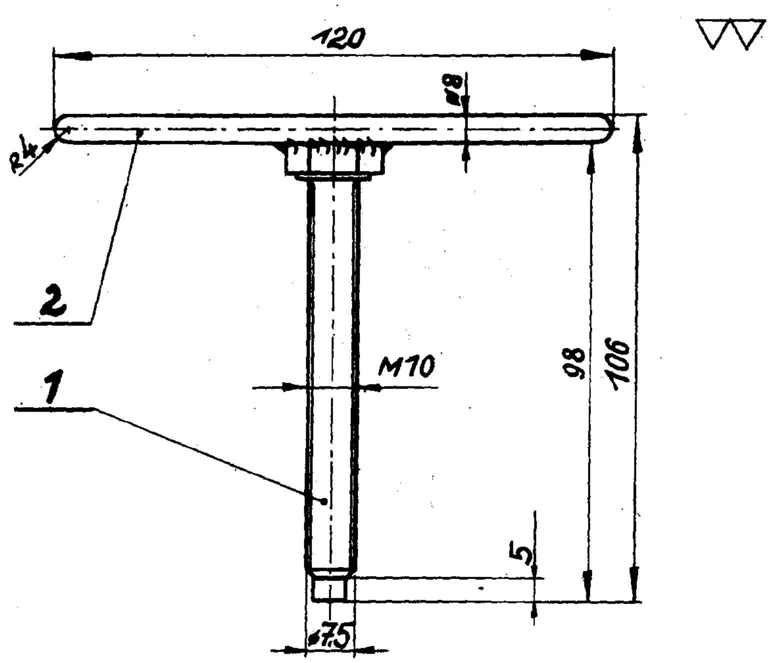
Part	Quantity	Description	Material	Rough Size	Remarks
1	1		St 38 b-2	30x10x72	TGL 7973
2	1	spring steel band 0.6 mm thick	C K 67	245 x 45	TGL 7975
3	1		C K 45	Ø 20x20	TGL 7970
4	1) welded		St 38 K	Ø 8x100	TGL 7970
5	1) part		St 38 K	Ø 5x30	TGL 7970
6		hexagon-head screw M 12 x 100			TGL 0-933
7	4	washer Ø 5.3			TGL 0-125
8	4	fillister-head screw M 5 x 12			TGL 0-84-5 S

12. Piston support 22-50.412



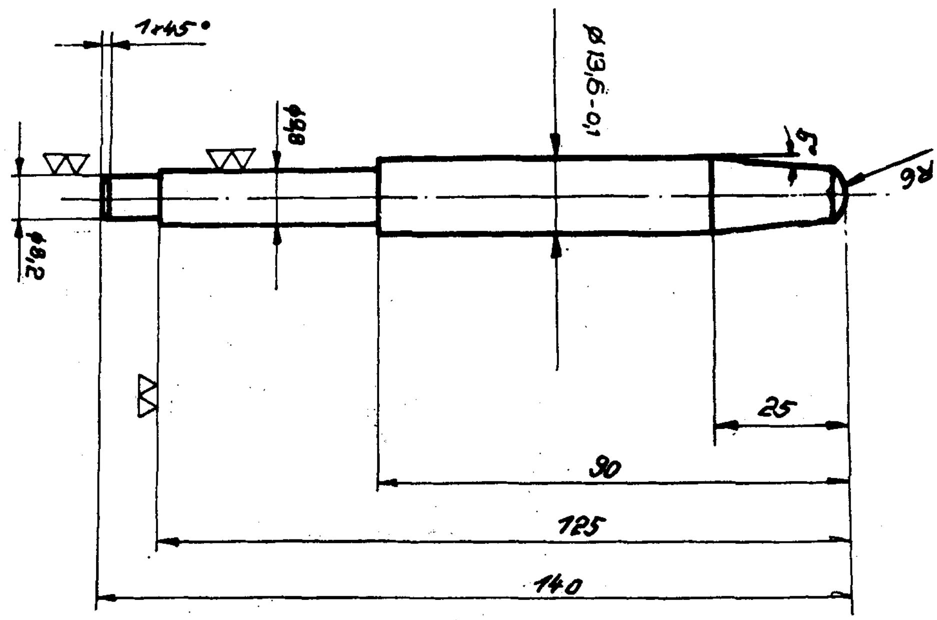
Part	Quantity	Description	Material	Rough Size	Remarks
	1	fork	HGW 2088	180x35x20	TGL 12 246

13. Anchor pulling screw (02-MW 39-4) 89-99.026



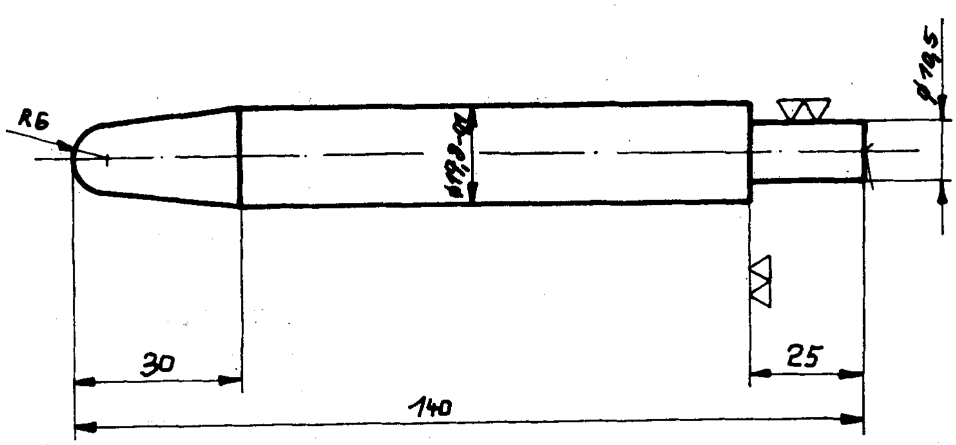
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	hexagon-head screw M 10 x 90			lug turned in lathe
2	1	handle	St 38 K	Ø 8 x 125	

14. Drift for locating sleeves (11-MW 3-4) 89-99.072



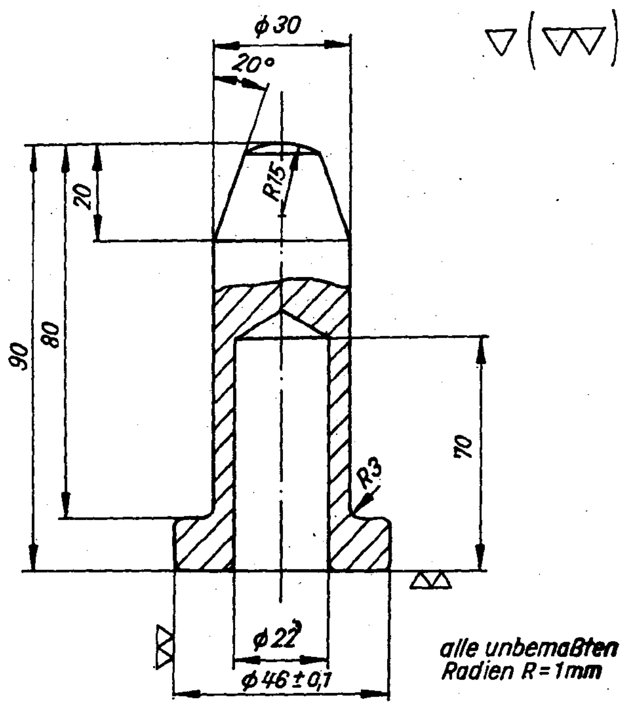
Part	Quantity	Description	Material	Rough Size	Remarks
	1	drift	C 15	Ø 15 x 145	case hardened

15. Guide mandrel for gudgeon pin (05 MW 19-4) 89-99.051



Part	Quantity	Description	Material	Rough Size	Remarks
	1	guide mandrel	St 38 b-2	Ø 20 x 145	

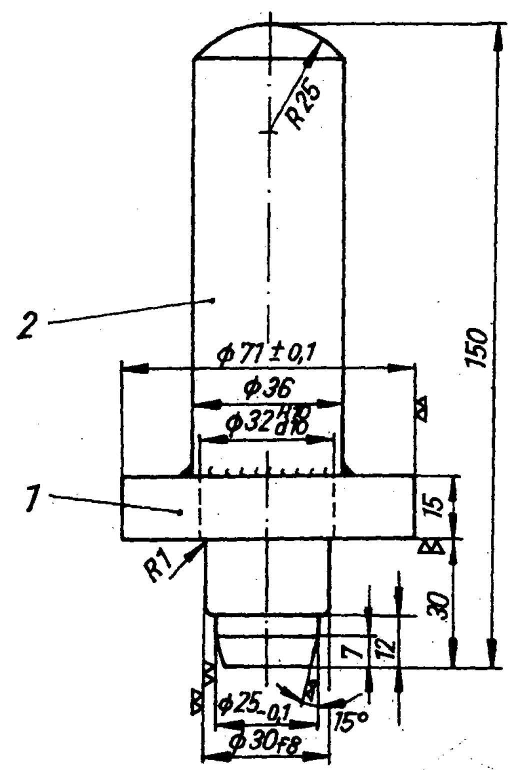
16. Drift for bearings 6203 and 6204 (11 MW 7-4) 89-99.073



alle unbemaßten Radien R = 1 mm = for all radii without dimension R = 1 mm

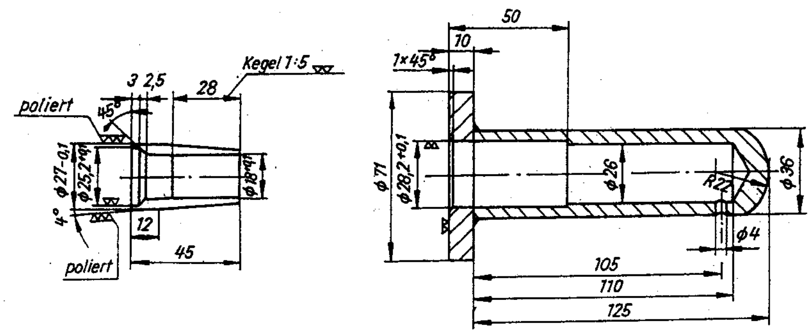
Part	Quantity	Description	Material	Rough Size	Remarks
	1	drift	C 15	∅ 50 x 100	case hardened

17. Drift for bearing 6306 29-50.405



Part	Quantity	Description	Material	Rough Size	Remarks
1	1		C 15	∅ 75 x 20	
2	1		C 15 K	∅ 36 x 155	

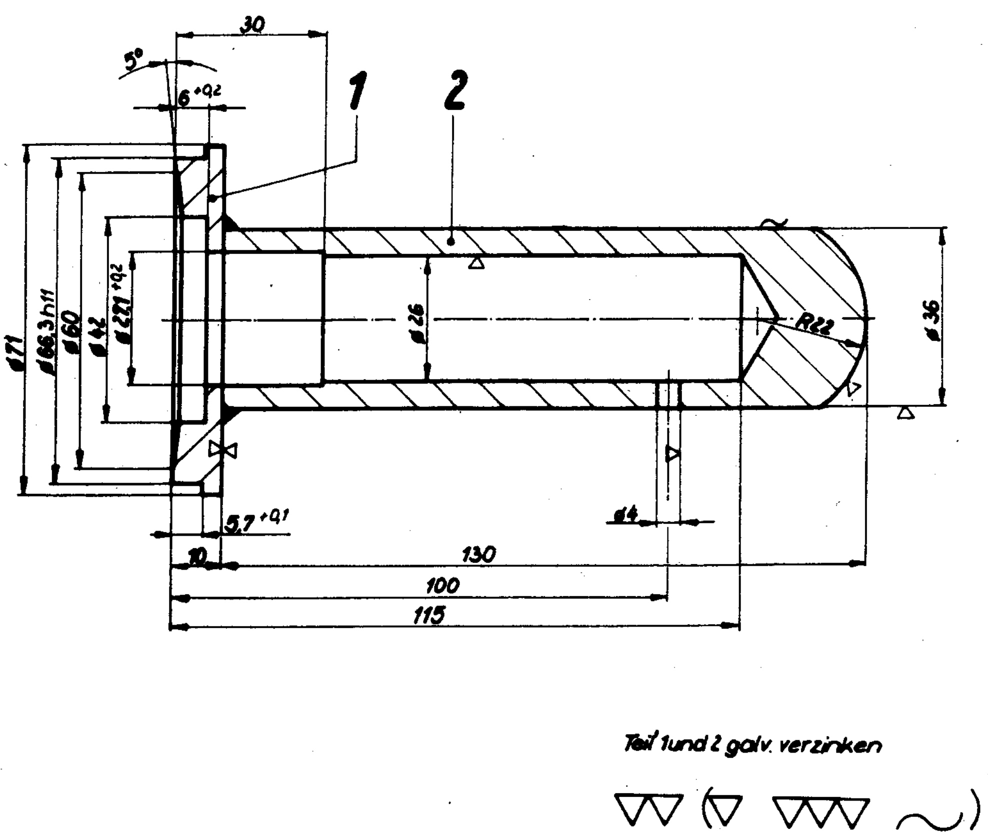
18. Fitting tool for packing ring (30x72x7) 29-50.406 (dynamo side)



poliert = polished   Kegel 1 : 5 = cone 1 : 5

Part	Quantity	Description	Material	Rough Size	Remarks
1	1 }	welded part	C 15	Ø 75 x 15	
2	1 }		C 15 K	Ø 36 x 130	
3	1	pipe 28 x 6	St 35 hb	50 long	TGL 14 100

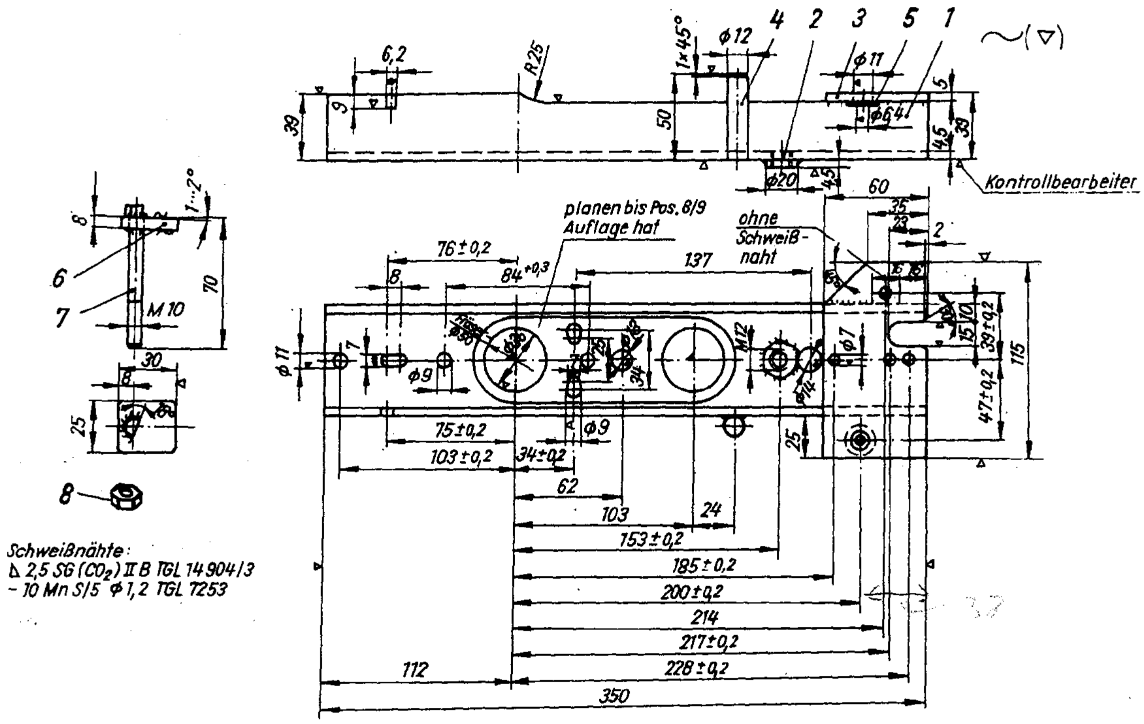
19. Fitting tool for packing ring (30x72x7) 29-50.409 (clutch side)



Teile 1 und 2 galvanisch verzinken = Parts 1 and 2 to be galvanised

Part	Quantity	Description	Material	Rough Size	Remarks
1	1 }	welded part	C 15	Ø 75 x 15	
2	1 }		C 15 K	Ø 36 x 135	

20. Assembling bridge 22-50.430



Schweißnähte: welding seams   Fräser Ø 50 = milling cutter 50 in diameter

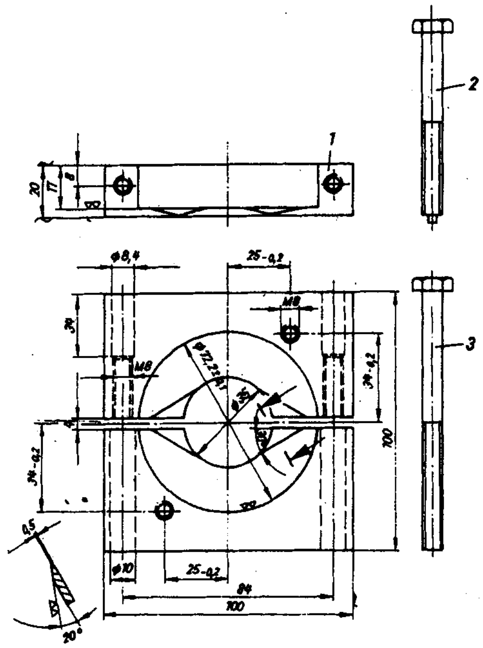
planen bis Pos. 8/9 = to be faced until items
Auflage hat 8/9 make contact

ohne schweißnaht = without welding seam

kontrollbearbeitet = control finished

Part	Quantity	Description	Material	Rough Size	Remarks
1	1	U-steel 6 1/2	St 38 b-2	350 long	TGL 0-1026
2	1		St 38 b-2k	Ø 20 x8	
3	1		St 38 b-2	5x60x115	welded part
4	1		St 38 b-2	Ø 12x55	
5	1	washer R 8.5			TGL 0-440
6	1		St 38 b-2	6x25x30	welded part
7	1	hexagon-head screw	M 10 x 70		TGL 0-931
8	1	hexagon nut	M 10		TGL 0-934

21. Ball bearing extractor bearing 6306 (22-50.431)

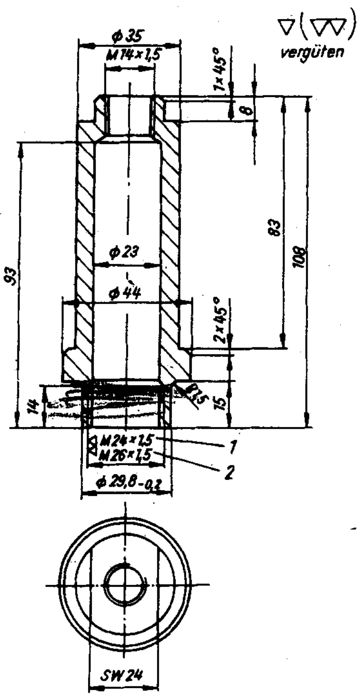


Für MM 250/4 ohne Ring

Zapfen gehärtet = pin hardened

Part	Quantity	Description	Material	Rough Size	Remarks
1	1		C 15	20x100x105	carbonitrided
2	2	hexagon-head screw	M 8 x 70		TGL 0-931
3	2	hexagon-head screw	M 8 x 100		TGL 0-933

22. Pulling sleeve clutch - thread M 24 x 1.5 (22-50.435)

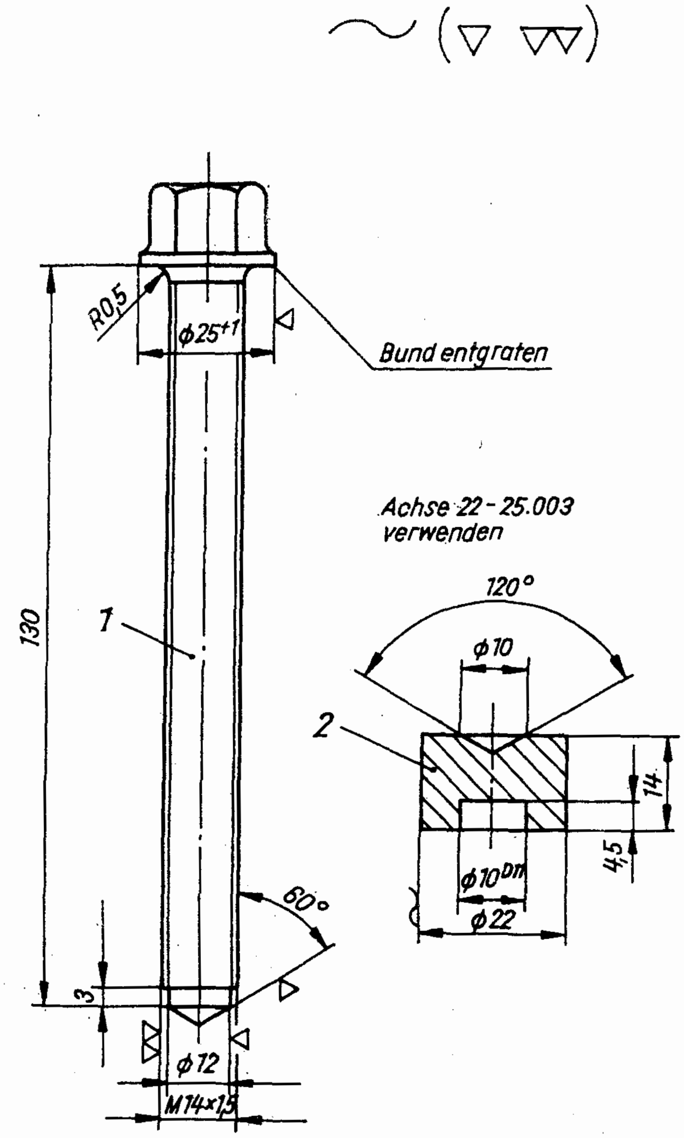


(1) for MM 250/4
(2) for MM 175/2, 250/2, 250/3

vergüten = to be hardened and tempered

Part	Quantity	Description	Material	Rough Size	Remarks
	1		C 45	Ø 45 x 112	hardened and temp.

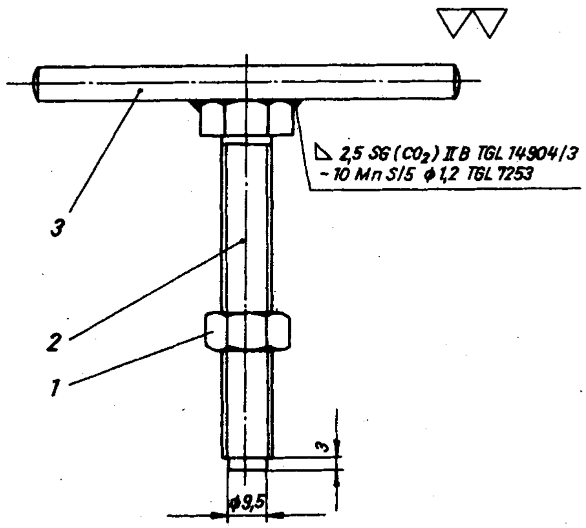
23. Pressing spindle with pressing piece 22-50.437



Bund entgraten = collar to be burred
Achse 22-25.003 verwenden = Use axle 22-25.003

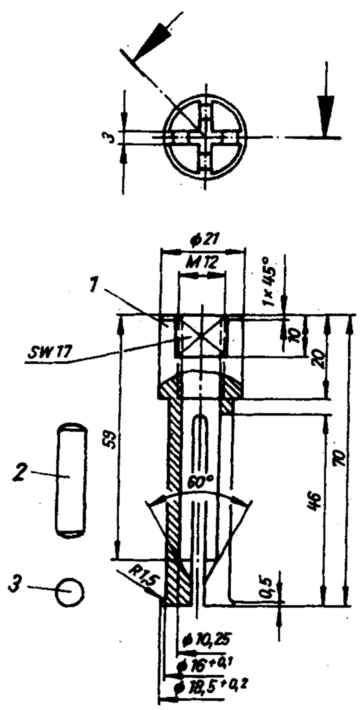
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	pressing spindle	C 60 K	Ø 15.4 x 169.5	
2	1	pressing piece	C 45 K	Ø 22 x 18	

24. Extracting screw for bearing 6203 (22-50.438)



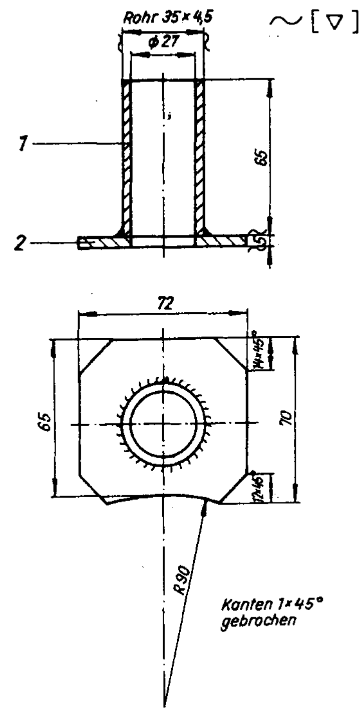
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	hexagon nut M 12			TGL 0-934
2	1	hexagon-head bolt M 12 x 80)	welded		TGL 0-933
3	1	cylindrical pin 8 x 6 x 100)	part		TGL 0-7

25. Clamping cartridge 22-50.439



Part	Quantity	Description	Material	Rough Size	Remarks
1	1	clamping cartridge	C 60	Ø 25 x 75	
2	1	bolt 10 x 40			TGL 0-1433
3	1	ball 9			TGL 15 515

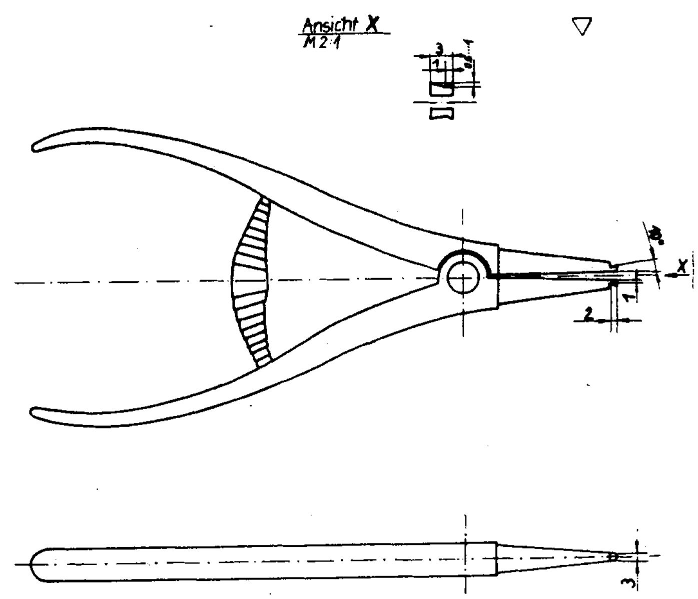
26. Spacer (not on sale by MZ)



Rohr 35 x 4,5 = pipe 35 x 4.5 Kanten 1 x 45° gebrochen = edges chamfered 1 x 4

Part	Quantity	Description	Material	Rough Size	Remarks
1	1	pipe) welded part		C 15 K	Ø 35 x 70
2	1	)		C 15	75 x 75

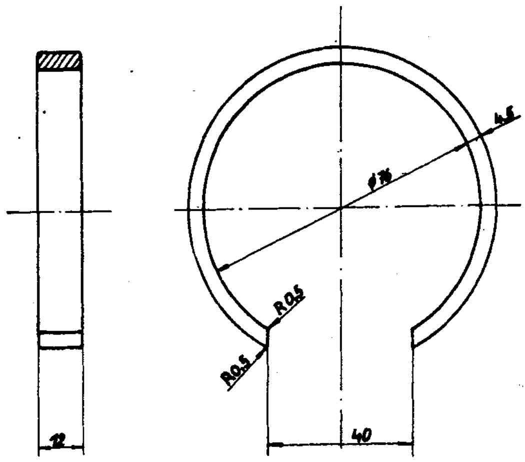
27. Piston ring pliers (05-MW 141-4) 89-99.124



Ansicht X M 2 : 1 = View X scale 2 : 1

Part	Quantity	Description	Material	Rough Size	Remarks
	1	lock-ring pliers A 1 60			TGL L 8-72 5

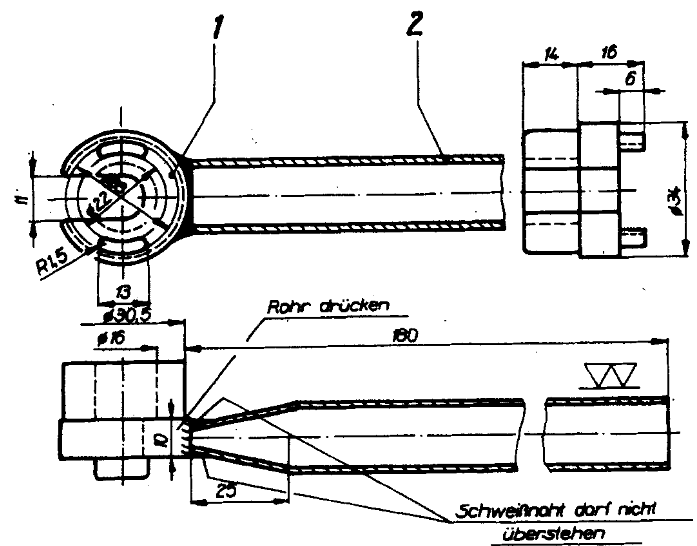
28. Clamping ring for piston rings 05-MW 147-4 (89-99.128)



For this tool also use special pliers 05-MW 141-4

Part	Quantity	Description	Material	Rough Size	Remarks
	1		St 38 u-2	Ø 90 x 15	

29. Special spanner for shock absorber (05-MW 82-4) 89-99.059



Rohr pressen = pipe to be pressed   Schweißnaht darf nicht überstehen = weld must not project

Part	Quantity	Description	Material	Rough Size	Remarks
1	1	ring	M ST 3	Ø 35 x 35	welded part
2	1	pipe 18 x 1.5	St 35 hb	185 long	

9. Tightening Torques - Engine

Nuts for the cylinder head	26 Nm (2.6 kpm)
Sparking-plug	40 Nm (4.0 kpm)
Fillister-head screws for casing, dynamo cover and clutch cover	13 Nm (1.3 kpm)
Screws for sealing cap of driving shaft	5 Nm (0.5 kpm)
Screws for retaining cap - dynamo	5 Nm (0.5 kpm)
Screw for armature fastening (dynamo)	20 Nm (2.0 kpm)
Stud bolts for cylinder fastening	20 Nm (2.0 kpm)
Clutch fastening nut	80 to 100 Nm (8 to 10 kpm)
Nut for drive gear 68 teeth	60 Nm (6.0 kpm)
Nut for sprocket wheel at gearbox	60 Nm (6.0 kpm)
Screws for end cap in clutch cover and speedometer drive	8 Nm (0.8 kpm)

10. Tightening Torques - Cycle Parts

Nut for control tube	150 Nm (15.0 kpm)
Screw plugs for telescopic fork	150 Nm (15.0 kpm)
Clamping screws at lower clamping head - telescopic fork	20 Nm (2.0 kpm)
Hexagonal socket-head bolt	20 Nm (2.0 kpm)
Clamping screw - front wheel axle	20 Nm (2.0 kpm)
Front-wheel and rear-wheel axle	80 Nm (8.0 kpm)
Nut for flanged bolt- rear wheel drive	80 Nm (8.0 kpm)
Suspension unit fastening, top	26 Nm (2.6 kpm)
Suspension unit fastening, bottom	45 Nm (4.5 kpm)
Engine fastening, rear	26 Nm (2.6 kpm)
Engine fastening at rubber element (cylinder head)	26 Nm (2.6 kpm)
Exhaust pipe fastening to cylinder	150 Nm (15.0 kpm)
M 8 fastening screws for exhaust system	26 Nm (2.6 kpm)
Swing-fork bearing bolt (springs fully extended)	70 to 80 Nm (7.0 to 8.0 kpm)

APPENDIX:

Wiring diagram of the electrical system MZ 6 V / 12 V